CARRIER AIR CONDITIONING SUPERFUND SITE

RECORD OF DECISION

RECORD OF DECISION
CARRIER A.C. SITE

TABLE OF CONTENTS

RECORD OF DECISION
CARRIER A.C. SITE

TABLE OF CONTENTS

RECORD OF DECISION
CARRIER A.C. SITE

TABLE OF CONTENTS

RECORD OF DECISION
CARRIER A.C. SITE

TABLE OF CONTENTS

DECLARATION FOR THE RECORD OF DECISION

SITE NAME AND LOCATION

Carrier Air Conditioning Site
97 Byhalia Road
Collierville, Tennessee 38017

STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Carrier Air Conditioning Site, in Collierville, Tennessee, which was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision document is based on the Administrative Record for this Site.

The Tennessee Department of Environment and Conservation concurs with the selected remedy.

ASSESSMENT OF THE SITE

Actual or threatened releases of hazardous substances from this site, if not addressed by implementing the response action selected in this Record of Decision (ROD), may present an imminent endangerment to public health, welfare, or the environment.

DESCRIPTION OF THE REMEDY

This final remedy addresses remediation of soils and groundwater contamination by eliminating or reducing the risks posed by the Site, through treatment, engineering and institutional controls.

The major components of the selected remedy include:

Contaminated soils and shallow groundwater in the old lagoon and main plant source areas will be remediated using soil vapor extraction.

Contaminated groundwater will be removed from the Memphis Sands aquifer using the existing extraction wells (at the City of Collierville Water Plant 2) and with supplemental wells. The contaminated groundwater will be treated by air stripping.

Extracted groundwater after treatment will be (1) utilized in the municipal water supply; (2) discharged to a local publicly owned treatment works (POTW); (3) discharged to surface water; or (4) reinjected to the Memphis Sands aquifer.

Periodic monitoring will be conducted to assess the effectiveness of the remedy for a period up to 30 years.

Institutional controls will be placed on well construction and water use in the general area of the Site.

STATUTORY DETERMINATIONS

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action and is cost-effective. This remedy utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable and satisfies the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element. Because this remedy will result in hazardous substances remaining onsite above health-based levels, a review will be conducted at least every five years beginning no later than five years from commencement of remedial action to ensure that the remedy continues to provide adequate protection of human health and the environment. Reviews may be conducted on a more frequent basis as EPA deems necessary.

9/3/92
Date

Greer C. Tidwell
for Regional Administrator

DECISION SUMMARY

1.0 SITE NAME, LOCATION, AND DESCRIPTION

1.1 Site Location

The Carrier Air Conditioning Site (also referred to as the Collierville Site) is located on the western side of the Town of Collierville, Shelby County, Tennessee. Shelby County, TN is located in the southwest portion of the State. The Site is located near the intersection of Poplar Avenue (U.S. Highway 72) and Byhalia Road. The address is 97 South Byhalia Road, Collierville, TN 38017. Collierville is located approximately 21 miles east of downtown Memphis, TN. Figure 1-1 is a location map showing the Carrier A.C. Site and vicinity. Figure 1-2 shows the Site itself and relevant features.

1.2 Site Topography

Currently the Site slopes gently to the South and West. The Site has been graded and filled in various locations in order to change drainage patterns and adapt the land for manufacturing use. In general the western portion of the property has been graded and leveled, with excess dirt moved to the areas under Buildings A and F. A pond located at the western edge of the Main Plant has been filled. A drainage ditch running east/west on the western side of the property was removed and an intermittent stream was rerouted around the area which became the Main Plant.

1.3 Geologic/Hydrogeologic Setting

The Memphis/Shelby County area is situated in two major physiographic subdivisions: the Mississippi Alluvial Plain and the Gulf Coastal Plain. The Carrier A.C. Site is located in the Gulf Coastal Plain which is distinguished by gently rolling topography and a characteristic thick layer of loess deposited during Pleistocene glaciation. Anomalous areas of loess deposition are associated with alluvial plains of Mississippi River tributaries that cross the area. These rivers include the Wolf River, the Loosahatchie River, and Nonconnah Creek. Nonconnah Creek runs through the Site boundaries.

Unconsolidated deposits, up to 3000 feet, overlie bedrock in the Memphis/Shelby County area. The sediments consist primarily of sand, clay, gravel, silt, and some lignite. The principal freshwater aquifers in the designated area are 1) the alluvium, 2) fluvial (terrace) deposits, 3) the Memphis Sand, and 4) the Fort Pillow Sand. The alluvium and fluvial deposits are separated in most areas from the Memphis Sands by the Jackson-upper Claiborne confining layer (locally referred to as the Jackson Clay). The Memphis Sands and the Fort Pillow Sands are separated by the Flour Island confining layer.

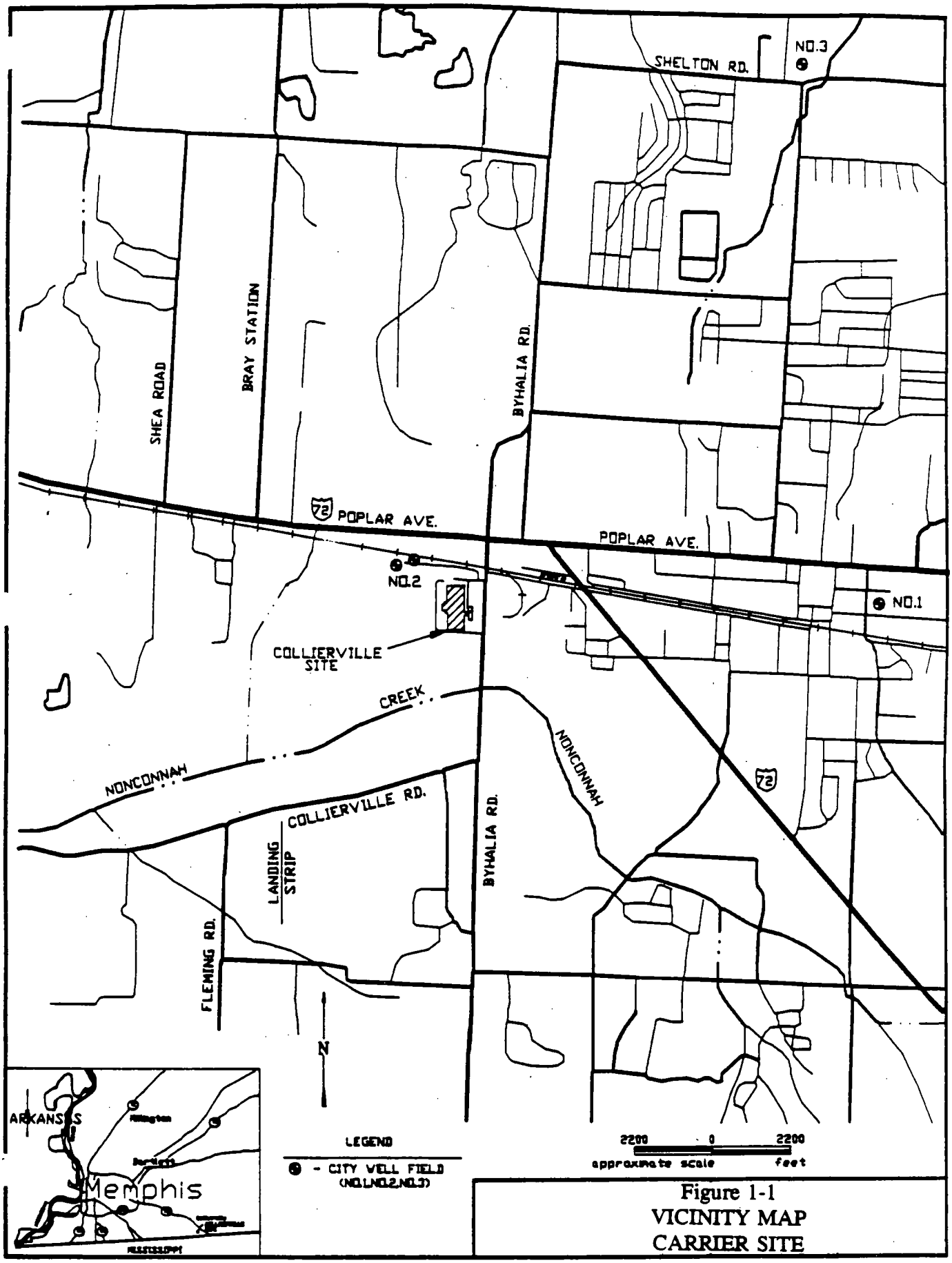
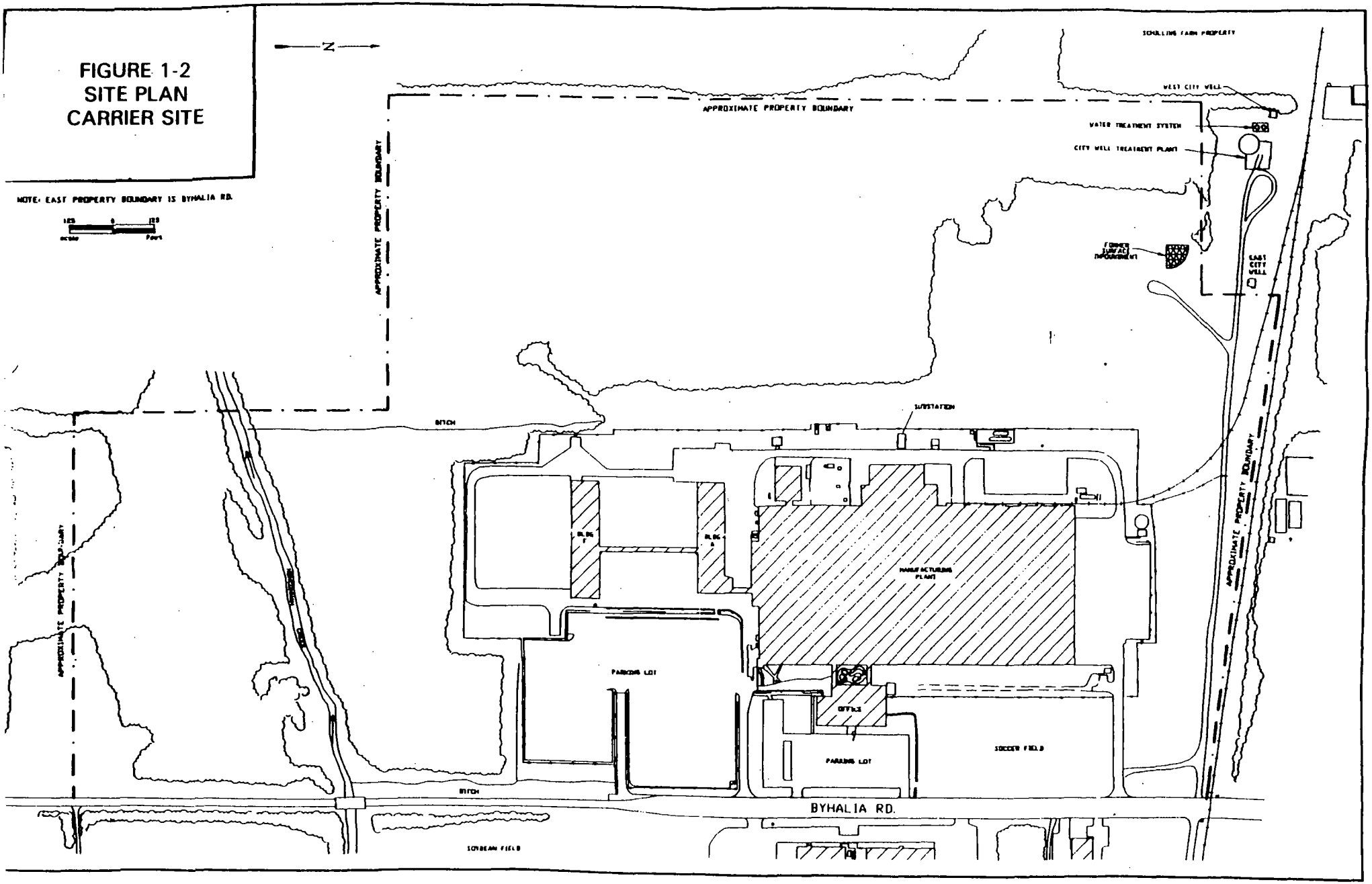


Figure 1-1
VICINITY MAP
CARRIER SITE

FIGURE 1-2
SITE PLAN
CARRIER SITE



Two aquifer units have been identified at the Site: (1) intermittent shallow water in the alluvial and fluvial deposits overlying a semi-confining clay unit, and (2) the Memphis Sand aquifer. The alluvium and fluvial deposits show inconsistencies throughout the region. The intermittent characteristic of shallow groundwater is due to undulations in the surface of the clay layer. These undulations capture and direct percolating groundwater along the top of the clay layer. The clay layer thins to non-existence between the Carrier plant building and Nonconnah Creek, resulting in a direct exchange between the shallow aquifer, where present, and the deeper Memphis Sand aquifer. The Memphis Sand consists of massive beds of fine to coarse grained well-rounded to sub-angular sand and gravels intercalated with thin lenses and beds of silt, clay and argillaceous, micaceous and lignitic materials. The Memphis Sand is confined throughout most of the Memphis area, except in the eastern and southeastern portions of Shelby County. The Fort Pillow Sand is artesian throughout the Memphis area and including the Carrier Site. Vertical interaquifer exchange between the Memphis Sand and the Fort Pillow Sand is restricted by the low hydraulic conductivity associated with the Flour Island confining layer.

The shallow aquifer is classified as a IIIA aquifer - groundwater not used as a drinking water source and has limited beneficial use. Also, this aquifer is highly to intermediately interconnected to adjacent groundwater units of a higher class and/or surface waters. The Memphis Sand is a Class IIA aquifer - groundwater that is currently used as a drinking water source and having other beneficial uses.

1.4 Meteorology

Collierville's climate is typical of the Memphis region which is humid with summer temperatures ranging from the low 80°s F to 100° F; and winter temperatures in the 40°s F. Average humidity is 50 to 60 percent. Average rainfall is 56 inches per year. Evapotranspiration averages 40 inches, most of which occurs between May and October. Average wind speed is 10 miles per hour in winter and 7 miles per hour in summer. Predominant wind direction is to the north-northeast.

2.0 SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 Facility Operations and History

The Site consists of approximately 135 acres owned principally by Carrier Corporation (Carrier) which operates a manufacturing facility on the property. In 1967, the Town of Collierville purchased the Site property from Robert and Grace Snowden. That same year, the Town of Collierville constructed industrial buildings and purchased industrial equipment for the Site. The property, buildings and equipment were leased to Carrier on March 1, 1967. In 1982, the lease was amended to exclude the northwest portion of the property where the Town of Collierville municipal wells are located. On December 14, 1987, Carrier purchased all the property included in the lease with the Town of Collierville.

In 1967 the Town of Collierville installed a well field for potable water on the northwest corner of the Site. The operation consists of two extraction wells, described as the West Well and the East Well, a treatment (aeration and chlorination) plant, and a storage tank. This operation is identified as Water Plant 2 and provides up to 1.4 million gallons per day of potable water to the Town of Collierville.

Carrier began manufacturing residential heating and air conditioning units in the late 1960s. Carrier's use consists primarily of four buildings: the main plant which is an assembly plant for air conditioning units, buildings A and F which contain storage and supporting operations, and an office building. In the process of assembling air conditioning units, aluminum sheeting is stamped and assembled with copper tubing to form air heat exchangers. Stamping and forming oils and dirt are removed from these parts prior to final assembly. Trichloroethylene (TCE) was, until recently, the primary solvent used to degrease and clean these parts. Two discrete releases (in 1979 and 1985) of TCE occurred from solvent storage systems to an area just south of the main manufacturing building. In addition, a wastewater lagoon, operated from about 1972 to 1979, apparently accepted waste contaminated with TCE and zinc.

Removal actions were conducted at the former lagoon in 1979 and both near-plant spill areas in 1979 and 1985. At the lagoon, approximately one foot of sludge was removed. Asphalt pavement and underlying soils were removed from the parking area affected by the 1979 spill of TCE from a degreaser vent pipe. In 1985, about 500 gallons of TCE from a nearby aboveground storage tank pipe were released. A massive soil excavation and disposal action was conducted to remove the affected soils. As a result of the spill, monitoring wells were installed at the facility.

Since the 1985 spill, the Tennessee Department of Environment and Conservation (TDEC) continued groundwater monitoring at the Site on a regular basis. In July 1986, one of the extraction wells in the Town of Collierville's Water Plant 2 was found to be contaminated with low levels of TCE. Although low levels of TCE were found in both wells of Water Plant 2, no TCE was found in any of the other City municipal water plants. Operation of the wells and the existing plants has continued under frequent monitoring. In 1990, packed aeration towers, also called air strippers, were installed by Carrier at Water Plant 2 to to remove TCE and its degradation products from raw water prior to entry into the chlorination system. The treatment system was designed to handle incoming TCE concentrations of up to 200 $\mu g/\ell$. Design, construction, and operation of this system was coordinated with and approved by the Tennessee Department of Water Supply (which permits water treatment systems), the Memphis Shelby County Health Department, Bureau of Pollution Control (which has delegated authority for air emissions permitting), the State of Tennessee Division of Superfund, and the Town of Collierville. EPA Region IV was kept informed of the action.

In 1987 and 1988, Carrier conducted an extensive Site investigation under an agreement with the TDEC. Sampling indicated measurable amounts of TCE in the soils and smaller amounts

in the groundwater at the Site. The Site investigation also confirmed the earlier finding of low TCE concentrations in the groundwater from Water Plant #2.

2.2 Enforcement Activities

In March 1987, the Site was placed on the TDEC's List of Hazardous Substance Sites. In June 1988, it was proposed for inclusion on EPA's National Priorities List (NPL), and became final in 1990.

On November 7th and 10th, 1988, EPA sent general notice letters to the following entities:

1. Town of Collierville
2. Carrier Corporation

The letters notified the potentially responsible parties (PRPs) of their potential responsibility for the release of hazardous substances at the Carrier Air Conditioning Site in Collierville, Tennessee. A special notice letter sent to Carrier requested that they conduct a Remedial Investigation and Feasibility Study (RI/FS) for the Site. On September 28, 1989, the Carrier Corporation and EPA entered into a Consent Order under which Carrier agreed to conduct the RI/FS.

3.0 COMMUNITY PARTICIPATION HIGHLIGHTS

Public participation requirements in CERCLA §§ 113(k)(2)(B)(i-v) and 117 were met in the remedy selection process. The Community Relations Plan was finalized April 25, 1990 for the Carrier Air Conditioning Superfund Site. This document lists contacts and interested parties throughout the government and the local community. The Plan also establishes communication pathways to assure timely dissemination of pertinent information.

On May 8, 1990, EPA held a public information session to announce the Carrier Site RI/FS start.

The RI/FS Reports and Proposed Plan for the Carrier Air Conditioning Site were released to the public on April 18, 1992. These two documents were made available to the public in both the Administrative Record and the information repository maintained at the Memphis/Shelby County Public Library, Collierville Tennessee and the EPA Region IV Records Center. The notice of the availability of these two documents was published in *The Collierville Herald* and *The Independent* on April 16, 1992. A public comment period was held from April 21, 1992 through May 21, 1992. An extension to the public comment period was not requested. In addition, a public meeting was held on April 30, 1992. At this meeting, representatives from EPA, TDEC, and the Town of Collierville answered questions about problems at the Site and the remedial alternatives under consideration. A transcript of the public meeting and response

to the comments received during the public comment period are included in the Responsiveness Summary, which is part of this Record of Decision. This decision document presents the selected remedial action for the Carrier Air Conditioning Superfund Site, chosen in accordance with CERCLA, as amended by SARA, and, to the extent practicable, the National Contingency Plan. The decision for this Site is based on the Administrative Record.

4.0 SCOPE AND ROLE OF RESPONSE ACTION

The selected remedy for the Site is intended to address the threats to human health and the environment. This remedial action will remove the threat posed by contaminated groundwater and soil at the Site. Remediating the soils will prevent the contaminants from adversely impacting the groundwater. Remediating groundwater will prevent ingestion or inhalation of contaminated groundwater at or above the Maximum Contaminant Levels (MCLs) and will restore groundwater to contamination levels below MCLs. This is the only ROD contemplated for the Site.

5.0 SUMMARY OF SITE CHARACTERISTICS

5.1 Nature and Extent of Contamination

Results of the Carrier Site Remedial Investigation (RI) show varying levels of TCE contamination on the property. Results from soil and groundwater sample analyses, and soil-vapor screening data confirm that the two spill areas and the former lagoon area are the sources of contamination of Site soils and groundwater. Tables 5-1, 5-2, and 5-3 summarize groundwater and soil analytical data collected during the RI. Figure 5-1 shows the location of the three source areas.

On July 15, 1986, the Town of Collierville's west well in Water Plant 2 adjacent to the Site was sampled by TDEC and found to contain TCE. Subsequent analyses conducted on a bimonthly basis have shown values of TCE in the untreated water from the west well ranging from 45 to 290 $\mu g/\ell$. Values in the east well have ranged from 5 to 34 $\mu g/\ell$ for the untreated waters. Values in treated water, prior to chlorination, averaged 4 $\mu g/\ell$, prior to the installation of a treatment system to remove TCE and have since been consistently less than 2 $\mu g/\ell$.

In addition to the Town of Collierville's Water Plant 2, 15 private wells have been identified by TDEC within three miles of the Site. Analyses of these wells by TDEC in September and October 1986 were negative for TCE to a detection limit of 0.1 $\mu g/\ell$. Private wells were again sampled in the RI with no TCE detected at a detection limit of 5 $\mu g/\ell$.

As part of the RI, soil samples collected within areas suspected to be impacted by the spills indicate a wide range of levels of contamination. Samples from these areas ranged in concentration from $<$ 0.5 $\mu g/kg$ to 1,550,000 $\mu g/kg$ TCE. The greatest concentrations (B-4,

TABLE 6-1
Summary of Groundwater Results

Parameter	Sampling Period/ Phase	No. Samples	No. Hits	Range, µg/l	Mean, µg/l
TRICHLOROETHENE	12/89	15	10	38-4400	1230
	4/90	17	10	9-14000	2800
	8/90	20	12	20-24000	3850
	11/90	25	13	23-7300	1840
	2/91	23	9	59-8700	2350
	4/91	23	11	8-12500	4400
	8/91	25	15	5-37000	3800
1,2-DICHLOROETHENE	12/89	15	7	7-5300	1530
	4/90	17	6	50-5400	2720
	8/90	20	8	5-3900	830
	11/90	25	9	8-12000	1480
	2/91	23	9	11-12000	1560
	4/91	23	7	7.2-6900	1200
	8/91	25	7	3-370	125
1,1-DICHLOROETHENE	11/90	25	2	9-14	12
	2/91	23	1		7.9
	4/91	23	1		4.75
	8/91	25	1		9
1,1,1-TRICHLOROETHANE	12/89	15	1		44
	4/90	17	0		
	8/90	20	0		
	11/90	25	1		120
	2/91	23	1		32
	4/91	23	2	135.2-824	480
	8/91	25	1		69
TETRACHLOROETHENE	12/89	15	0		
	4/90	17	0		

TABLE 6-1
Summary of Groundwater Results

Parameter	Sampling Period/ Phase	No. Samples	No. Hits	Range, µg/l	Mean, µg/l
TETRACHLOROETHENE	8/90	20	0		
	11/90	25	0		
	2/91	23	1		27
METHYLENE CHLORIDE	12/89	15	0		
	4/90	17	2	7-160	85
	8/90	20	0		
	11/90	25	1		7
	2/91	23	2	27-35	31
	4/91	23	6	8-997	210
	8/91	25	7	3-11	6
ACETONE	12/89	15	2	200-320	260
	4/90	17	6	12-860	450
	8/90	20	0		
	11/90	25	1		6
	2/91	23	8	7.2-156	45
	4/91	23	4	3.2-790	250
	8/91	25	5	9.1-50	24
CARBON DISULFIDE	12/89	15	0		
	4/90	17	3	9-75	34
	8/90	20	0		
	11/90	25	3	7.58	24
	2/91	23	2	11-78	45
	4/91	23	1		17.1
	8/91	25	1		11
VINYL CHLORIDE	11/90	25	2	1-5	3
	2/91	23	1		3.4
	4/91	23	2	2.27-8.51	5.5
	8/91	25	0		

TABLE 5-1
Summary of Groundwater Results

Parameter	Sampling Period/ Phase	No. Samples	No. Hits	Range, µg/l	Mean, µg/l
TOLUENE	11/90	25	1		5
	4/91	23	0		
	8/91	25	1		7
1,2-DICHLOROETHANE	2/91	23	1		43
trans 1,3-DICHLOROPROPENE	2/91	23	1		46
	4/91	23	0		
	8/91	25	1		7.4
BROMODICHLOROMETHANE	2/91	23	1		42
DIBROMOCHLOROMETHANE	4/91	23	1		824
cis 1,3-DICHLOROPROPENE	2/91	23	1		37
BROMOCHLOROMETHANE	2/91	23	1		48
LEAD	12/89	15	3	4-106	42
	4/90	16	9	2.4-152	43
	8/90	20	20	1.4-54.2	19
	11/90	25	21	1.1-278	30
	2/91	26	11	4.9-198	50
	4/91	19	12	3.9-454	134
	8/91	25	17	1-246	80
ZINC	12/89	15	14	2.2-21900	4010
	4/90	16	15	20.6-30300	6800
	8/90	20	19	11-19800	4840
	11/90	25	21	12-146000	11650
	2/91	26	24	10-30500	5600

TABLE 5-2
Summary of Town Well Raw Water Samples

Parameter	Sampling Period/ Phase	No. Samples	No. Hits	Range, µg/l	Mean µg/l	Standard Deviation, µg/l
TRICHLOROETHENE	8/90	6	3	2-27	12	13
	11/90	6	2	34-45	40	8
	4/91	2	2	20-103	61.5	41.5
	8/91	2	2	5-290	147.5	142.5
	11/91	2	2	11-79	45	34
1,2-DICHLOROETHENE	8/90	6	0			
	11/90	6	0			
	4/91	2	0			
	8/91	2	0			
	11/91	2	0			
VINYL CHLORIDE	8/90	6	0			
	11/90	6	0			
	4/91	2	0			
	8/91	2	0			
	11/91	2	0			
LEAD	8/90	6	6	1.2-7.6	4	2
	11/90	6	1		3	
	4/91	2	2	28.2-42	35.1	6.9
	8/91	2	2	27-45	36	9
	11/91	2	0			
ZINC	8/90	6	6	10-272	57	96
	11/90	6	5	11-115	56	40
	4/91	2	2	1390-3350	2370	980
	8/91	2	2	1290-6680	3985	2695
	11/91	2	0			

TABLE 5-3
Summary of Soils Results

Parameter	Sampling Period/ Phase	No. Samples	No. Hits	Range, µg/kg	Mean, µg/kg	Standard Deviation, µg/kg
TRICHLOROETHENE		56	8	8-1,200,000	152000	420000
1,2-DICHLOROETHENE		56	3	14-200	78	110
TETRACHLOROETHENE		56	1		11	
1,1,2-TRICHLOROETHANE		56	1		26	
TOLUENE		56	4	6-87	40	60
2-BUTANONE		56	1		190	
ACETONE		56	3	12-35	26	13
LEAD (mg/kg)		39	33	0.67-21.4	7	4
ZINC (mg/kg)		39	26	3.3-77.8	33	15

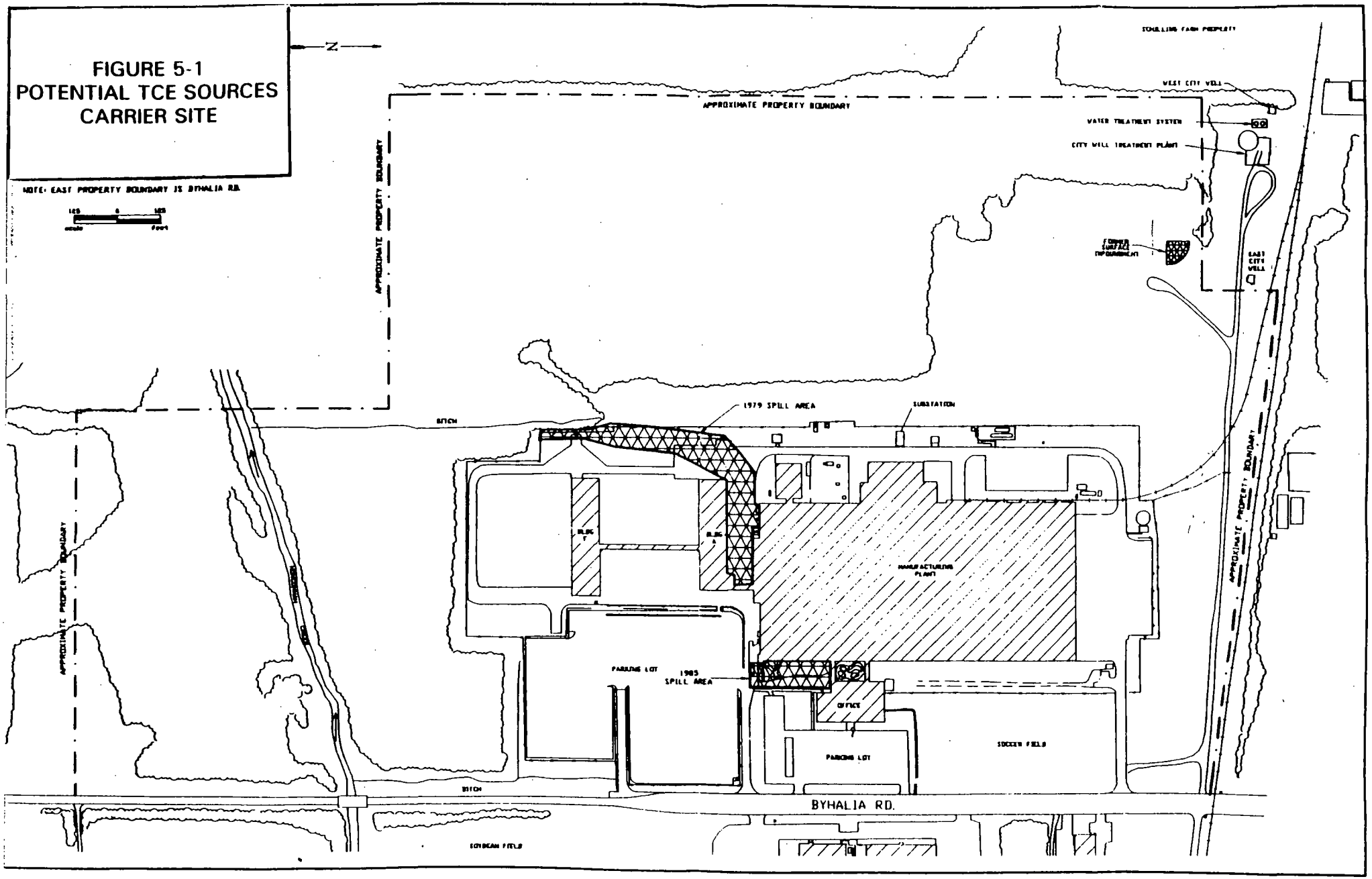


FIGURE 5-1
POTENTIAL TCE SOURCES
CARRIER SITE
N
NOTE: EAST PROPERTY BOUNDARY IS BYHALIA RD.
APPROXIMATE PROPERTY BOUNDARY
APPROXIMATE PROPERTY BOUNDARY
APPROXIMATE PROPERTY BOUNDARY
APPROXIMATE PROPERTY BOUNDARY
TOWELLING FARM PROPERTY
WEST CITY WELL
WATER TREATMENT SYSTEM
CITY WELL TREATMENT PLANT
EAST CITY WELL
1979 SPILL AREA
SUBSTATION
DITCH
BLDG F
BLDG A
MANUFACTURING PLANT
PARKING LOT
1985 SPILL AREA
OFFICE
PARKING LOT
SOCCER FIELD
DITCH
BYHALIA RD.
SOYBEAN FIELD

B-9, B-21, and B-38) were from those areas more directly associated with the 1979 degreaser spill. The vertical extent of TCE contamination is variable throughout the Site. Soil screening methods indicate that many of the sample's concentration levels decrease with depth. However, there are samples which indicate an increase in concentrations as the zone of saturation in the shallow aquifer is approached. Soil samples collected from the former lagoon area (borings B-17, B-18, B19, and B-40) confirm the presence of TCE. Figures 5-2 and 5-3 are isocon maps which graphically display the TCE soil testing results in the plant and lagoon areas.

Upon completion of the RI, 37 groundwater monitoring wells (identified generally in this ROD as MWs) were present at the Site.

Concentrations of chlorinated hydrocarbons consisting primarily of TCE and *cis* and *trans* isomers of 1,2-dichloroethene (DCE) were found in samples collected from most of the monitoring wells screened in the upper aquifer.

The latter compound and vinyl chloride are natural degradation products of TCE. Total chlorinated hydrocarbon (TCH) concentrations in these wells range from 70 $\mu g/\ell$ at MW-23 to 19,900 $\mu g/\ell$ at MW-19 during the last RI sampling period in February 1991. Figures 5-4 and 5-5 are facility layouts that identify all onsite and offsite monitoring wells.

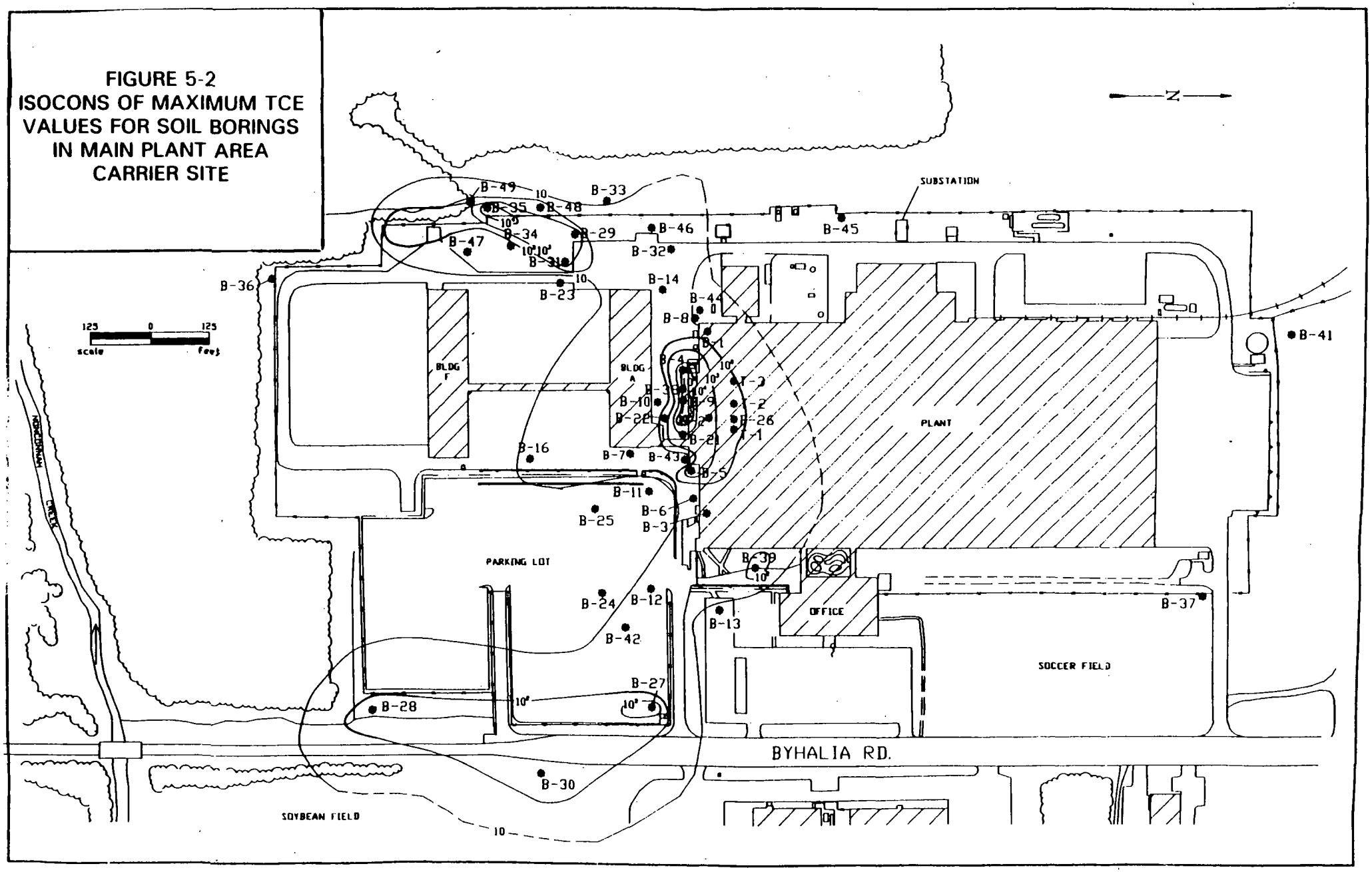
Elevated levels of two metals, lead and zinc, were seen in Site shallow groundwater samples. In shallow soils, lead values range from 7 to 15 mg/kg. Average lead values decrease with depth in virtually all Site soils, except at the former lagoon area. Zinc values show a similar pattern. Otherwise, no pattern of metals contamination or a source area has been defined.

The former lagoon area may serve as a source of zinc due to the use of zinc phosphate on the Site and the discharge of zinc phosphate sludges to the lagoon. However, the closure of the lagoon in 1980 appears to have removed these sludges and residual concentrations are low.

5.2 Contaminant Distribution, Fate and Transport

There have been three documented sources of chlorinated hydrocarbon contamination at the Carrier Site as described above. Residual contaminants from these source areas are still in specific areas. Furthermore, TCE and its degradation products have been identified in groundwater. Groundwater contamination has been identified at the Carrier Site in close proximity to the 1979 spill site and the former sludge impoundment in the shallow aquifer, and within the Memphis Sand aquifer. The mechanics for migration of TCE from the source areas to the aquifers depend on solvent-specific characteristics, site-specific geology and hydrogeology. With respect to solvent characteristics, TCE has been characterized as an immiscible fluid with a density greater than that of water, and is classified as a dense non-aqueous-phase liquid. Figure 5-6 illustrates the possible mechanisms for movement of TCE in both soils and

FIGURE 5-2
ISOCONS OF MAXIMUM TCE VALUES FOR SOIL BORINGS IN MAIN PLANT AREA CARRIER SITE



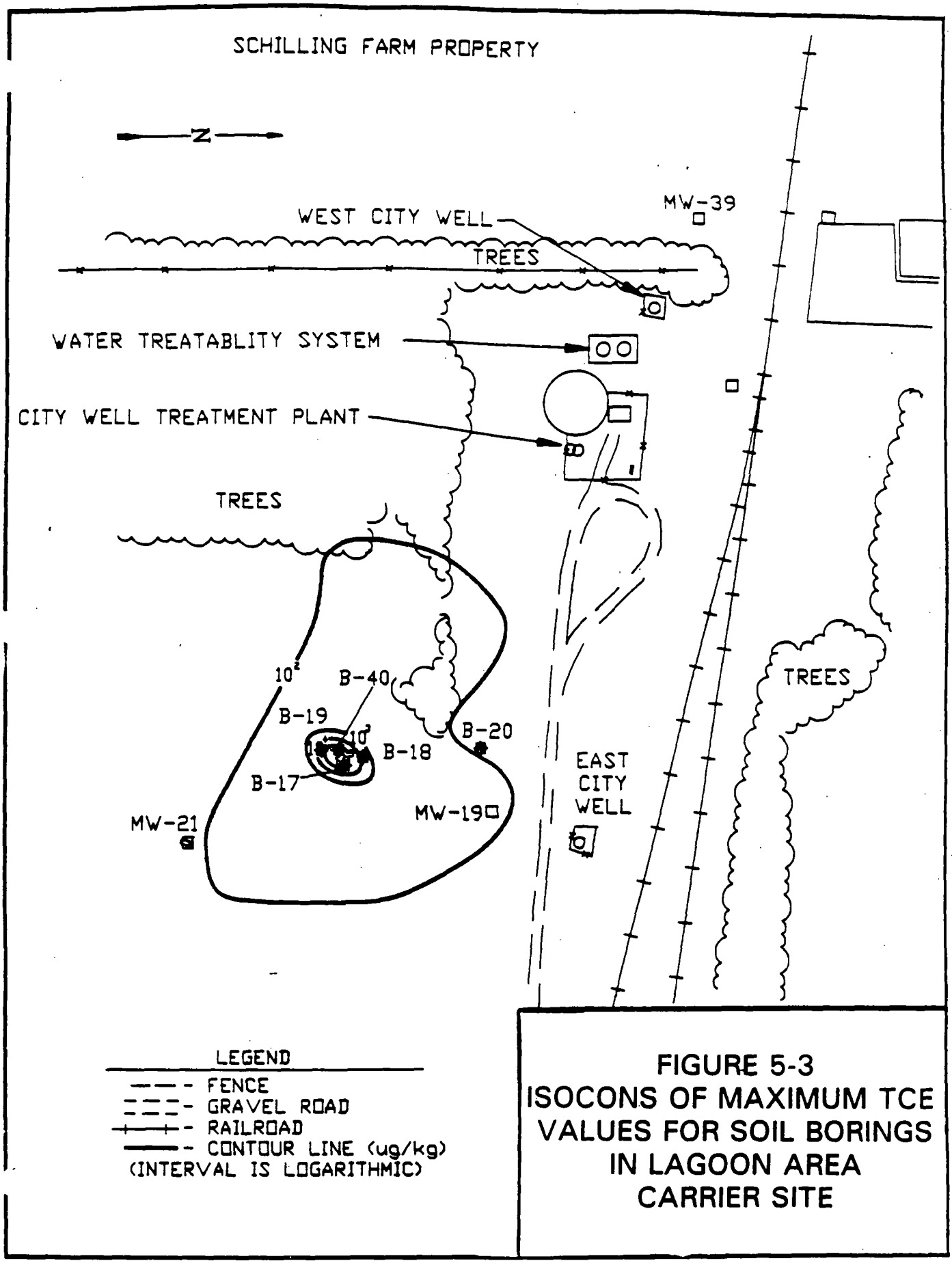


FIGURE 5-3
ISOCONS OF MAXIMUM TCE VALUES FOR SOIL BORINGS IN LAGOON AREA CARRIER SITE

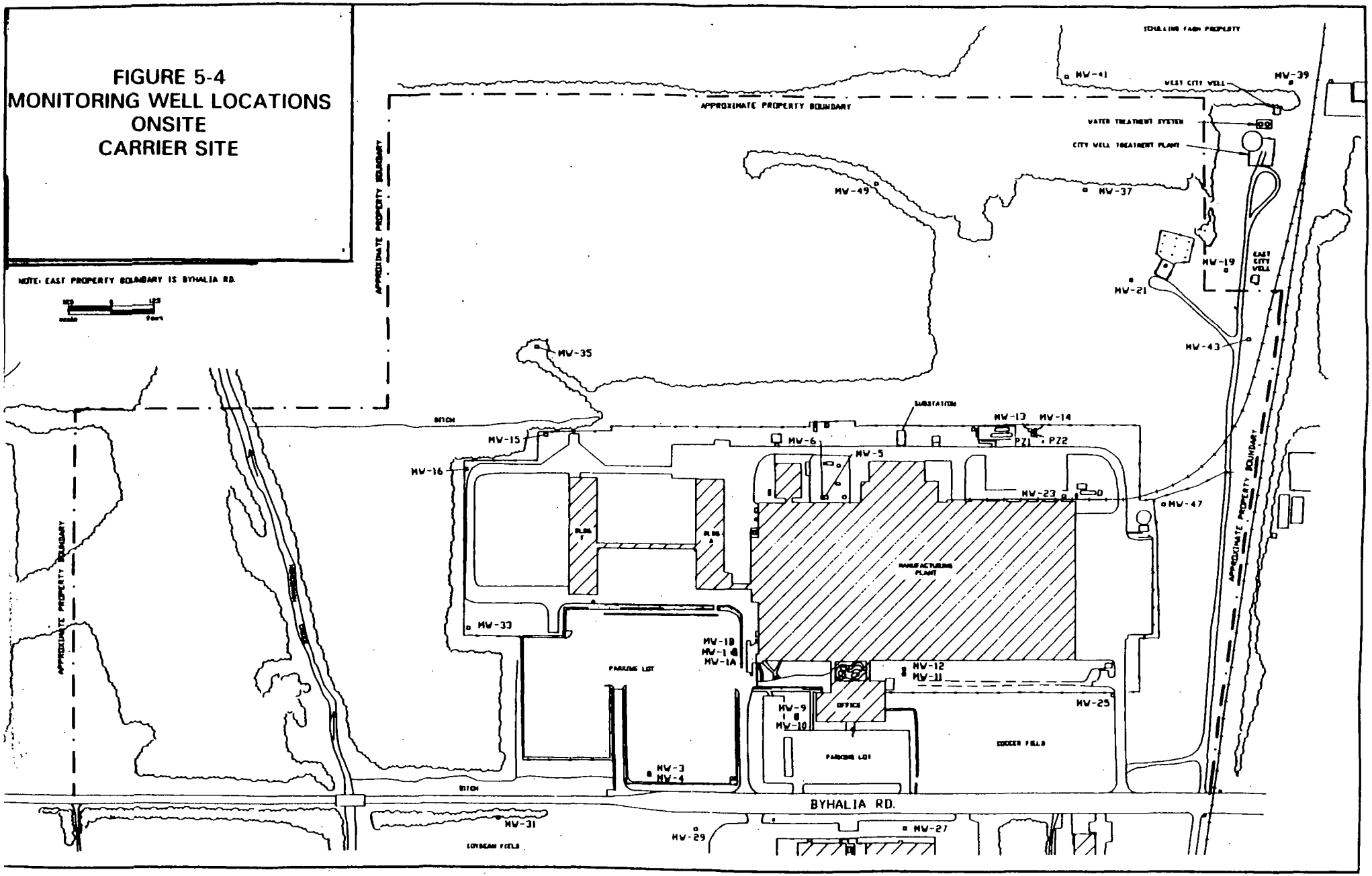


FIGURE 5-4
MONITORING WELL LOCATIONS
ONSITE
CARRIER SITE
NOTE: EAST PROPERTY BOUNDARY IS BYHALIA RD.
APPROXIMATE PROPERTY BOUNDARY
MW-41
MW-39
WEST CITY WELL
WATER TREATMENT SYSTEM
CITY WELL TREATMENT PLANT
MW-49
MW-37
MW-19
MW-21
MW-43
MW-35
SUBSTATION
MW-13
MW-14
PZ1
PZ2
MW-15
MW-6
MW-5
MW-16
MW-23
MW-47
MANUFACTURING PLANT
MW-33
MW-18
MW-1B
MW-1A
PARKING LOT
MW-12
MW-11
MW-25
OFFICE
MW-9
MW-10
SOCCER FIELD
MW-3
MW-4
BYHALIA RD.
MW-31
SOYBEAN FIELD
MW-29
MW-27

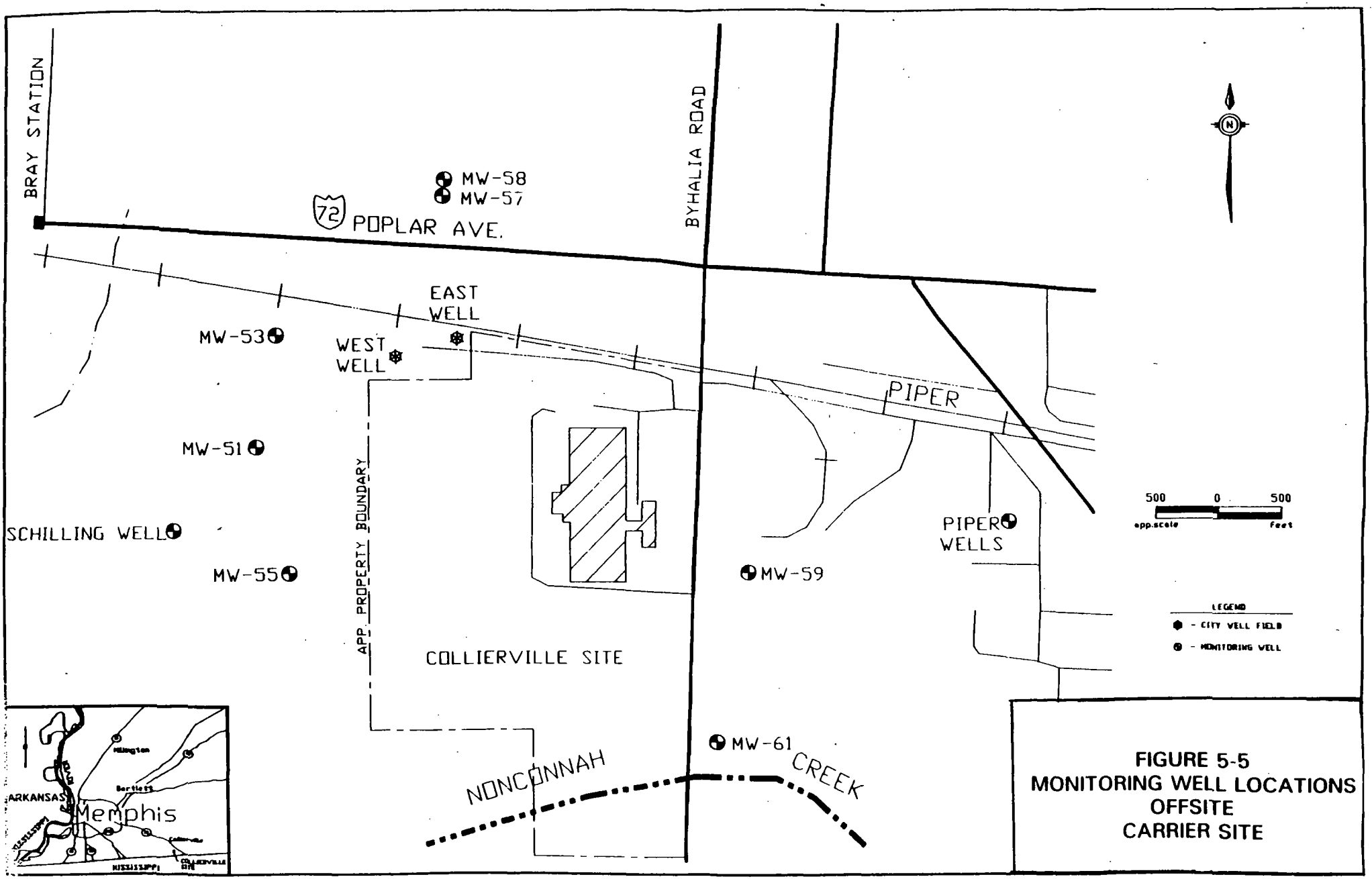


FIGURE 5-5
MONITORING WELL LOCATIONS
OFFSITE
CARRIER SITE

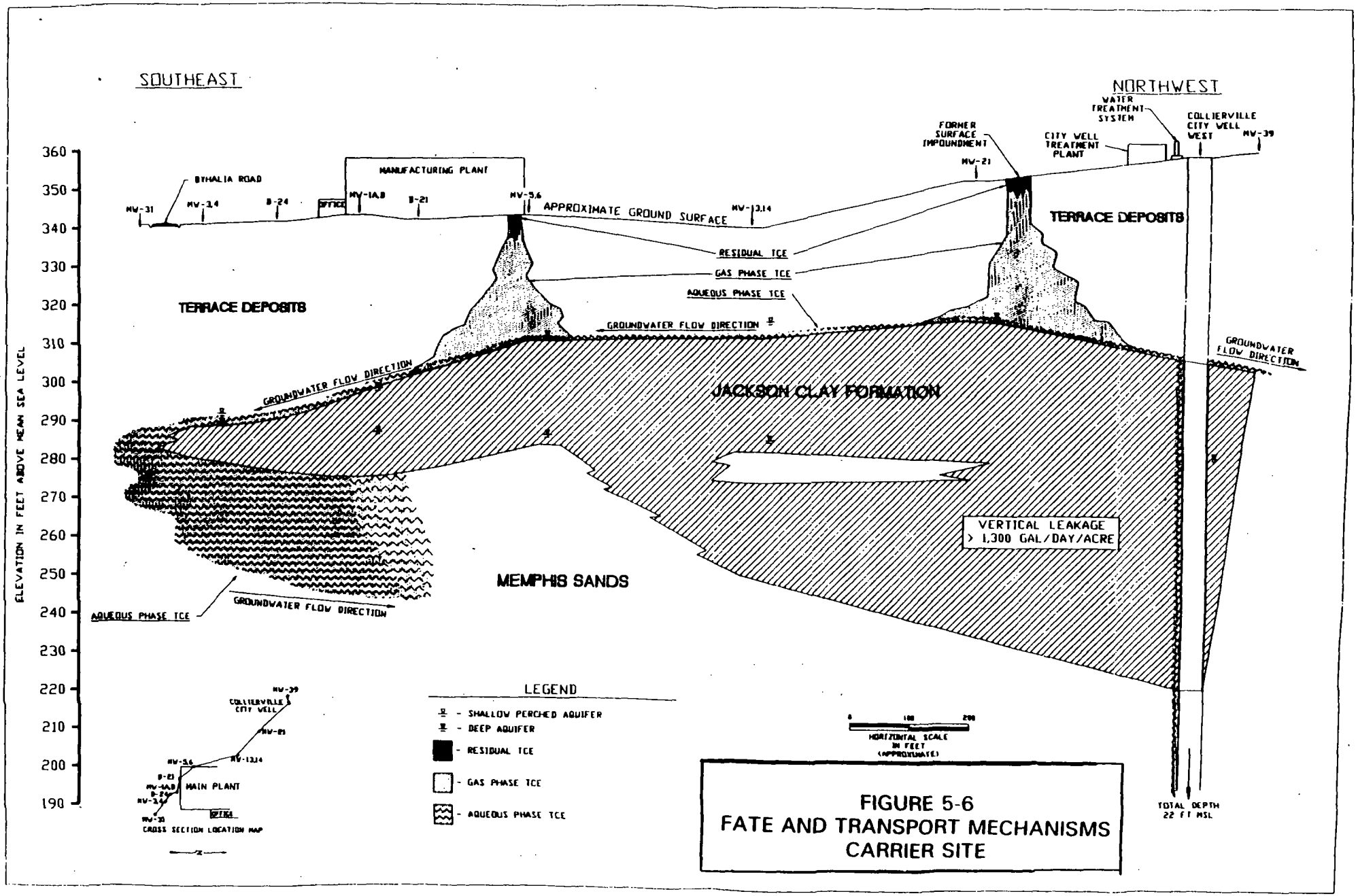


FIGURE 5-6
FATE AND TRANSPORT MECHANISMS
CARRIER SITE

groundwater as seen in results of the RI. Due to the immediate response and removal of soils impacted from the 1985 spill, the spill area has not been included in the figure.

Vadose Zone

Soil boring demonstrates that TCE is migrating through the vadose zone. Residual solvent remains adsorbed within the pore space of the soil particles as TCE migrates through the soil. TCE migrates from soils through diffusion in the vapor phase and in the dissolved aqueous phase from the infiltration and percolation of rainwater through soils.

Shallow Aquifer

Upon reaching groundwater, the further movement of TCE in the shallow aquifer correlates closely with the structure of the underlying aquitard. Groundwater in the shallow aquifer moves radially from a "structural high" in the Jackson Clay in the proximity of the former lagoon. The Jackson Clay formation grades from this "high" to the south toward Nonconnah Creek, to the southeast towards Byhalia Road, and generally to the west, along the western extent of the Carrier property. There is some evidence of a slight grade to the north as well, in the vicinity of the town wells and further north.

Advective transport of contaminants in the aqueous phase, from source areas around the main plant and the former lagoon, follow natural shallow groundwater flow directions at the Site. There is some evidence that groundwater in the upper aquifer flows only intermittently. This is substantiated by the poor recharge to some of the shallow monitoring wells. Significant amounts of groundwater may be present in localized depressions with very little lateral movement except during high recharge periods. However, around contaminant source areas this movement is generally to the southeast, along the top of the Jackson Formation.

The stratigraphic investigation clearly indicates that shallow groundwater movement to the south and east will eventually migrate to an area in which the Memphis Sand aquifer and the shallow aquifer unit are hydraulically connected.

Memphis Sand Aquifer

Flow direction in the Memphis Sand is to the northwest, as seen from potentiometric measurements made during periods when the town wells were not pumping. TCE contamination has been identified in the Memphis Sand in the southeast portion of the Site (MW-1, MW-1B, and MW-4) and at the municipal wells.

The density of TCE in water at maximum water solubilities of less than 2 $\mu g/\ell$ is not likely to be sufficient to cause sinking of the plume. Therefore, movement of the contaminants to the well field will be more directly dependent upon the pumping rates of the city well system and resulting drawdown effects on the Memphis Sand aquifer.

The results of the Site investigation suggest that other pathways also exist. Regional geologic data suggest that recharge through the Jackson Clay is relatively low because of low clay permeability across the unit. However, the aquifer pumping test conducted at the Site indicated a potential for vertical leakage through this confining clay layer. The vertical leakage or recharge rates range from 0.9 to 18.8 gallons per minute per acre. As determined in that aquifer test, these rates suggest that leakage through the aquitard may be a potential pathway for TCE to enter the Memphis Sand aquifer.

5.3 Treatability Study

As part of the RI a treatability study was conducted at the lagoon area to determine how effective soil vapor extraction (SVE) would be for removing TCE and its degradation products from onsite soils and shallow groundwater. The treatability study, also referred to as the North Remediation System (NRS), has indicated that this technology is effective in removing contamination in soils and shallow groundwater.

6.0 SUMMARY OF SITE RISKS

A baseline risk assessment (BRA) has been conducted for the Carrier Site, and the results are presented in Section 8 of the RI report. The BRA was based on contaminated environmental Site media as identified in the RI. It was conducted in order to provide an assessment of the resulting impact to human health and environment if contaminated soils and groundwater at the Site were not remediated.

The Carrier BRA concluded that the primary health risk posed by the Site is through ingestion and inhalation of TCE and lead from untreated groundwater.

6.1 Contaminants of Concern

The selected contaminants of concern for Site soils and groundwater are shown in Table 6-1. Seven major hazardous contaminants were considered. Of these, trichloroethylene (TCE) and dichloroethylene (DCE) were the most frequently detected and generally found at the highest concentrations. Although TCE and DCE are the primary contaminants of concern, lead, zinc, 1,2-dichloroethane (DCA), tetrachloroethylene (PCE) and vinyl chloride were also included due to their presence in one or more sample wells at an average concentration which equalled or exceeded the current or proposed MCLs.

DCA, PCE and vinyl chloride have not been identified at a significant frequency in either groundwater or soils. DCA and PCE are commonly associated with TCE because solvents are rarely pure products and often contain a small residual amount of other chlorinated hydrocarbons. Vinyl chloride is a common degradation product of TCE.

No pattern of lead or zinc in groundwater was established in Site soils or groundwater. Lead was not historically used onsite. The old lagoon area may be a potential source of zinc due to the use of zinc phosphate on the Site and the discharge of zinc phosphate sludges to the lagoon. However, the closure of the lagoon in 1980 appears to have removed these sludges and residual concentrations are low. The high level of metals may be caused from a secondary effect of the TCE contamination/degradation, except perhaps beneath the former lagoon. Degradation of TCE may be lowering the pH causing the insoluble metal complexes to leach into groundwater. Lead and zinc may also be attributed to naturally occurring levels and/or non Site-related anthropogenic sources.

Contamination was not indicated in any surface water samples; therefore, this medium was not further evaluated. Lead and zinc were detected in sediment samples and are included as contaminants of concerns in Table 6-1.

6.2 Exposure Assessment

The objectives of the exposure assessment are to identify actual or potential exposure pathways; characterize the potentially exposed populations; and to determine the extent of the exposure. The results of the exposure assessment are combined with the chemical-specific toxicity information to characterize the potential risks.

The Site is located near a state road in a developed community setting. The site exists in the small and growing community of Collierville, Tennessee (pop. ~ 13000). With the current strict zoning, the long-term future use of this Site would be for continued industrial use. The Site is an operating facility and will continue to be so for the foreseeable future. Therefore, it seems prudent to assume that direct and frequent contact by adults in an industrial setting will continue to occur. The Site is fenced and secured. The occurrence of infrequent trespassers would pose a likely current exposure scenario with direct exposure to the southern and western portions of the Site. The nearest residential area is approximately 100' north of the Site boundary adjacent to the Collierville municipal well field.

None of the nonpaved areas appear to receive heavy foot traffic or constitute obvious pathways for routine exposure[1]. However, direct soil or dust contact could result in exposure to trespassers and the workers onsite.

Irrigation from the shallow water bearing zone (thin, low yielding zone lying above the Jackson Clay) is not feasible due to the poor production of this unit. Irrigation from the deeper aquifer

[1]Approximately 20% of the 190-acre Site is paved or covered by buildings. Approximately 50 to 60% of the contaminant source areas are beneath paved or covered areas.

TABLE 6-1
Contaminants of Concern by Environmental Media
Carrier Site

SOIL/SEDIMENT
TCE
DCE
Vinyl Chloride*
PCE
DCA
Lead
Zinc
GROUNDWATER
TCE
DCE
Vinyl Chloride*
PCE
DCA
Lead
Zinc

*Vinyl chloride was not detected on-site in any media at a significant frequency, but is considered a common degradation product of TCE.

system (the Memphis Sands) would be possible, but would not significantly contribute to overall risk due to the following factors:

- The site is an operating industrial facility.
- The organic contaminants of concern have low bioconcentration factors (<50) and high Henry's Law constants. The uptake by crops is expected to be minimal.
- The primary metals of concern are zinc and lead. Zinc is a trace element, and both are not available to plants for uptake until soil levels reach >50 ppm.
- Groundwater metals concentrations are not significantly above background concentrations.

Surface waters do not exist onsite or adjacent to the Site with the exception of Nonconnah Creek in which no water sample contamination was detected.

No significant direct inhalation exposure onsite is expected as a large portion of the contaminated area is paved/covered. The unpaved areas of the Site are far less contaminated and are covered by maintained vegetation (grasses and trees/shrubs). Soil contamination exists at the highest levels at depths from one to five feet (subsurface vs. surface, 0-1'). These factors along with the mild southeast inland climate (average wind speeds of 5-10 mph) contribute to insignificant passive volatilization of Site contaminants. Also, the facility has an operating air permit which allows approximately 200 tons of total VOCs per year to be emitted. The maximum combined air stripper output annually has been estimated at <500 lbs/year. Passive volatilization from the Site would not contribute significantly to VOC air emissions or risk. Active volatilization (such as soil gas vapor extractions) will be addressed in the Description of Alternatives and Compliance with ARARs sections.

Shallow groundwater is not currently used for domestic purposes in the immediate area. The shallow aquifer is classified as a Class IIIA aquifer. The nearest known municipal well is located adjacent to the northwest corner of the Site. The deep groundwater flow is best described as to the northwest (influenced by pumping). The Memphis Sand aquifer is classified as a Class IIA aquifer. Groundwater contaminant exposure was computed for current and future use of water produced by the Memphis Sand aquifer. Current groundwater pathways exist for local residents supplied by the Collierville municipal well system. Future exposure was assessed via a hypothetical pathway involving residential wells screened in the Memphis Sands. Groundwater contaminant ingestion and inhalation of volatilized groundwater contaminants were considered to determine total exposure through the groundwater pathway. The maximum concentration of each parameter observed in the untreated municipal well water was used to compute current risk (conservative assumption). Future resident reasonable maximum exposure (RME) concentrations were established by computing the 95% upper confidence limit mean for each constituent of concern from wells screened in the Memphis Sand aquifer.

The highest groundwater concentrations onsite were generally observed in monitoring wells located in the shallow water bearing zone (which is not used as a potable water source in the Site vicinity). Actual current exposure to groundwater contaminants (through the municipal system)

is minimized (or eliminated) by engineering controls (i.e. air stripping of municipal well water prior to distribution). Volatile contaminant concentrations subsequent to the air stripping unit are below MCLs. Use of the shallow water bearing zone and the Memphis Sand aquifer as a potable water source is restricted by city and county ordinances. Both these ordinances control and regulate the location and construction of wells in Collierville and Shelby County.

Current and future exposure pathways to hazardous substances associated with the Site include direct soil contact via ingestion and dermal contact; and groundwater expsoure via inhalation/bathing and ingestion (Table 6-2).

6.3 Toxicity Assessment

Seven contaminants have been positively identified and quantified at the Site. They are TCE, DCE, PCE, DCA, vinyl chloride, lead and zinc. DCE exists in two isomeric forms, *cis* and *trans*. Isolation of the two isomers in routine analytical determinations is difficult and subject to error. Therefore DCE is usually reported as the total of all isomers. DCE is considered an equivocal carcinogen. However, the two isomers do exhibit somewhat different toxicities. Therefore, as a conservative approach, the more toxic of the two isomers is used in risk assessment. In general, the *cis*-1,2-DCE isomer is considered the more toxic. A secondary degradation product of TCE, vinyl chloride, has not been identified at the Site in any media at significant frequencies or concentrations (four hits ranging from 1 to 8.51 ppb). Over a long period of time, however, degradation of DCE to vinyl chloride has been known to occur. Zinc and lead are the metals of concern at the Site, however, observed concentrations do not vary significantly from background, and no Site-related source of lead has been established.

In addition to the potential toxicity of TCE and vinyl chloride, most of these substances can produce systemic toxic responses at doses greater than an experimentally-determined threshold level. The USEPA has derived Slope Factor[2] and/or Reference Dose (RfD)[3] values for these substances for use in determining the upper bound level of cancer risk and noncancer hazard from exposure to a given level of contamination (Table 6-3).

Drinking water standards (MCLs) have been established for some contaminants detected in groundwater impacted by Site activities (Table 6-3). These contaminants include hazardous substances identified as carcinogens and systemic toxicants in published research studies.

---

[2]Slope Factor. A plausible upper-bound estimate of the probability of an individual developing cancer as a result of a lifetime of exposure to a particular level of a potential carcinogen.

[3]Reference Dose. EPA's preferred toxicity value for evaluating noncarcinogenic effects resulting from exposures at Superfund sites. *See specific entries for chronic RfD, subchronic RfD, and developmental RfD. The acronym RfD, when used without other modifiers, either refers generically to all types of RfDs or specifically to chronic RfDs. It never refers specifically to subchronic or developmental RfDs.

TABLE 6-2
Potential Complete Exposure Pathways for Risk Assessment Considerations
Carrier Site

• Ingestion of and dermal contact with contaminated soil by on-site workers, trespassers (e.g., children), and hypothetical, future, onsite residents.[a]
• Ingestion of contaminated groundwater by current municipal water system users (before treatment) and hypothetical, future residents obtaining their water from an on-site well screened in the Memphis Sand aquifer.[b]
• Inhalation of chemical vapors emanating from contaminated groundwater during showering by current municipal water system users (before treatment) and hypothetical, future residents obtaining their water from an on-site well screened in the Memphis Sand aquifer.[b]

[a] Exposure rates (CDI) for ingestion and dermal contact with contaminated soils by future child residents were calculated to be (mg/kg-day) TCE = 4.8×10^{-5}, DCE = 1.2×10^{-6}, Pb = 1.9×10^{-4}, Zn = 8.2×10^{-4}, and PCE = 1.8×10^{-7} (1.5×10^{-8} for carcinogenic effects). Appendix P of the RI contains calculations used to derive exposure concentrations (RMEs).

[b] Exposure concentrations for chemical intakes for chemical intakes (ingestion and inhalation) related to groundwater were determined as follows:

Current Resident- maximum concentration detected (before treatment) in the Collierville municipal well system water

Future Resident- 95% upper confidence limit mean contaminant concentration detected in monitoring wells screened in the Memphis Sand aquifer

Current after treatment exposure/risk levels were not computed as contaminant concentrations in treated municipal well system water are below analytical detection limits.

TABLE 6-3
Health-Based Values for Carcinogens (SF) and Noncarcinogens (RfD) and ARARs for Oral Exposure to Contaminants of Concern Carrier Site

Contaminant	SF_{oral} $(mg/kg\text{-}day)^{-1}$	$SF_{inhalation}$ [g] $(mg/kg\text{-}day)^{-1}$	RfD (mg/kg-day)	Cancer Weight of Evidence	ARAR (mg/l)
Trichloroethylene (TCE)	1.1×10^{-2} [a]	0.017	NA	B_2	0.005
1,2-Dichloroethene (DCE)	NA	NA	0.01 [e]	D	0.07 [b]
1,2-Dichloroethane (DCA)	9.1×10^{-2}	0.091	NA	B_2	0.005
Tetrachloroethene (PCE)	5.1×10^{-2}	1.1×10^{-1} [h]	0.01	B_2/C [f]	0.005
Vinyl Chloride	1.9 [e]	1.8×10^{-1} [h]	NA	A	0.002
Lead	NA	NA	0.0004 [d]	B_2/C [f]	0.015
Zinc	NA	NA	0.21 [e]	D	5 [e]

[a] Not on IRIS 4/91, based on USEPA, 54 & 1-86-046.
[b] Based on unit risk for drinking water (est. from CPF/RfD)
[c] Not on IRIS 4/91, based on USEPA, ECAO-CIN-P155
[d] Calculated unit risk based on 0.015mg/l action level (hazard index = 1) and ingestion rate of 2 liters/day and 70 kg average body weight
[e] Not on IRIS 4/91, based on USEPA, AWQCD, 440/5-80-079 (2 MCL)
[f] Not yet determined or being reconsidered
[g] HEAST, 1/91
[h] Inhalation Unit Risk assuming IR_a = 15m³/day; BW=70 kg.

NA = Not applicable or not determined (pending)

Cancer Weight of Evidence
- A = Human Carcinogen
- B2 = Probable Human Carcinogen- sufficient evidence in animals and inadequate or no evidence in humans.
- C = Possible Human Carcinogen
- D = Not Classifiable as to Human Carcinogenicity

Critical studies used in their toxicity classification by the USEPA are shown in the Integrated Risk Information System (IRIS) data base. These standards are considered as ARARs for the surface and groundwater at the Site. They are considered as "Relevant and Appropriate" since the Memphis Sands aquifer is currently used as a domestic water supply. A copy of the IRIS database outputs for each parameter are included as Appendix Q of the RI.

6.4 Risk Characterization

Site soil contaminants are not uniformly distributed over the surface, but exist in areas of varying concentrations. This pattern of contaminant distribution was managed for risk assessment purposes by considering the risk from exposure to the unpaved/uncovered portions of the Site which have shown soil contamination in the upper five feet of soil. Conservative estimates based on the total area of the Site which has surface contamination were used to assess current adult worker exposure to volatile contaminants of concern. The entire unpaved/uncovered area of the Site was used to assess the risk to adult workers posed by lead and zinc in the Site surface soils. In both instances, the workers were assumed to contact the Site uniformly. To assess the risk posed by the Site to future child residents, it was assumed that the entire Site will be unpaved and uncovered, and that all potential ingestion and dermal contact exposures would occur within the contaminated surface soil zones. The mean concentration of a contaminant found in samples collected in the upper five feet of soil was considered as the exposure level (for both ingestion and dermal contact scenarios).

The result of the risk calculation for the major soil contaminants, using the above stated assumptions, are shown in Tables 6-4 and 6-5. In Table 6-4, the risk to workers from the major contaminants of concern is shown. In Table 6-5, the risk to future child residents is shown. Since the risk values represent a fraction of time exposed uniquely to a contaminant in the contaminated areas, the sum of these risk values (5.2×10^{-7}) approximates the child's upper bound risk. This value does not represent the total risk from the Site since neither 100% of a future child resident's onsite time nor exposure to all Site contaminants is accounted. However, the remaining unaccounted risk is presumed to represent an insignificant additional risk. Vinyl chloride has been determined to pose little or no current risk to human health due to the infrequency of detection and low concentrations identified.

These data indicate that exposure to contaminated surface soils does not pose an upper bound risk level greater than the 10^{-6} point of departure for current Site workers or future children onsite.

The Hazard Index values as shown (Tables 6-4 and 6-5) indicate that onsite exposures would not result in noncancer toxicity to the current adult workers or future child residents onsite. As a result, lead and zinc are not considered to pose a significant health risk from the standpoint of soil ingestion or dermal contact.

TABLE 6-4
Summary of Risks for Adult Workers from Oral and Dermal Exposure to Contaminants in Soil
Carrier Site

Soil Contaminant Level (mg/kg)[a]	Contaminant	Upper Bound Risk Level[b] (or Hazard Index)
35	TCE	1.0×10^{-7}
0.077	1,2-DCE	HI=7.2×10^{-6}
0	Vinyl Chloride	0[c]
0	DCA	0
0.011	PCE	1.5×10^{-10} HI=1.0×10^{-6}
12[e]	Lead	HI=2.8×10^{-2}
51[e]	Zinc	HI=2.3×10^{-4}
Upper bound Sum cancer risk = 1.0×10^{-7}		
Upper bound Sum hazard indices = 0.028		

[a] X concentration in all soils within surface contaminated areas (90-95% C.L. was not calculated as the data are not normally distributed); for metals X concentration assumed to be in all unpaved/uncovered site soils. TCE and 1,2-DCE concentrations are the means for all samples collected at depths of 0 to 5 feet, including screening data from Phase I (see Appendix P).

[b] HI (Hazard Index) of >1 are a cause for concern. Upper bound risk levels of 10^{-4} to 10^{-6} are considered on a case-by-case basis as to their acceptability by the USEPA.

[c] Approximately 89 ppm of vinyl chloride in soil at this site with these assumptions would equal 1×10^{-6} risk level.

[d] Tetrachloroethene (PCE) was identified in one soil sample.

[e] Lead and zinc concentrations for all samples collected from within five (5) feet of ground surface were used to compute mean values.

TABLE 6-5
Summary of Risks for Potential Future Child Residents from Oral and Dermal Exposure to Contaminants in Soil
Carrier Site

Soil Contaminant Level (mg/kg)[a]	Contaminant	Upper Bound Risk Level[b] (or Hazard Index)
35[e]	TCE	5.2×10^{-7}
0.077[e]	1,2-DCE	$HI = 6.1 \times 10^{-6}$
0	Vinyl Chloride	0[c]
12[f]	Lead	$HI = 1.9 \times 10^{-1}$
0	DCA	0
0.011	PCE	$HI = 1.7 \times 10^{-6}$
51[f]	Zinc	$HI = 3.9 \times 10^{-3}$
Upper bound Σ cancer risk = 5.2×10^{-7}[g]		

[a]X concentration in all site soils within five (5) feet of ground surface where TCE and/or DCE has been identified; assume 100% of Future Child Resident soil exposure is in contaminated area on-site

[b]HI (Hazard Index) of >1 are a cause for concern. Upper bound risk levels of 10^{-4} to 10^{-6} are considered on a case-by-case basis as to their acceptability by the USEPA.

[c]1×10^{-6} risk (with these assumptions) in soil ~150 ppb vinyl chloride

[d]Lead is not bioavailable to humans below approximately 200 ppm in soils. The USEPA has recommended a soil lead level of 500 to 1,000 ppm at NPL sites (to protect from direct contact and ingestion). A site-specific lead exposure model is currently being tested by the USEPA (USEPA/ECAO 6/91, personal conversation with Dr. Harlal Choudhury)

[e]TCE and 1,2-DCE data from samples collected prior to the initiation of the Remedial Investigation were included. Below detection limit results were not used in the calculation of means.

[f]Lead and zinc concentrations for all samples collected from within five (5) feet of ground surface were used to compute mean values.

[g]Example calc. are the same as Figure 8-2b except child assumptions (Figure 8-3) were used.

NOTE: It was assumed that in the future the entire site will be unpaved and uncovered. The shallow water bearing zone is not currently used as a source or potable water nor is it anticipated to be used as a potable source in the future. Therefore, it was not considered a viable future exposure pathway.

Table 6-6 shows that, assuming worst-case conditions, Site groundwater may pose a significant carcinogenic and non-carcinogenic risk to current and future residents. The upper bound cancer risk to current residents posed by the groundwater exposure pathway is $2.5x10^{-4}$. The Hazard Indices for lead and zinc are 3.2 and 0.87, respectively, under the current resident scenario. The lead value indicate that a non-carcinogen risk may be posed to current residents. Maximum contaminant concentrations in untreated Collierville municipal well system water were used to compute current risk (and hazard indices).

The upper bound cancer risk to future Site residents from the groundwater exposure pathway is $4.7x10^{-4}$. The hazard indices for DCE, lead and zinc are 0.33, 4.1, and 0.82, respectively, under the future resident scenario. The contaminant concentrations (Reasonable Maximum Esposure (RME)) used to compute risk (and Hazard Indices) to future Site residents were the 95% upper confidence limit mean values for all deep monitoring wells computed over three quarterly sampling periods. As a result, the risk levels computed are highly conservative estimates.

It is worthy of mention that lead concentrations (which pose the primary non-carcinogenic risk) observed in the Memphis Sand monitoring wells are not significantly different than those observed in background wells. The 95% upper confidence limit mean for lead in wells CMW-001 and CMW-002 (background wells) over the same monitoring period was 0.061 mg/L (versus 0.060 mg/L in the Memphis Sand wells). The maximum concentration of lead observed in untreated municipal well system water was 0.045 mg/L (over the same sampling period). As a result, the Hazard Indices computed for lead (under current and future exposure scenarios) may not be directly attributable to the Site, and may result from natural lead content of the aquifer material or non Site-related anthropogenic sources. Appendix P of the RI provides data tables and statistics used to establish RMEs as well as background well 95% upper confidence limit determinations. Although metal concentrations are variable and sometimes high in background wells, the range of concentrations are higher onsite. The higher concentrations may be a secondary effect of the TCE contamination/degradation which may be lowering the pH,leaching otherwise insoluble metal complexes into groundwater.

The shallow water bearing zone is not currently used as a source of potable water nor is it anticipated to be used as a potable source in the future. Therefore, it was not considered a viable future exposure pathway.

The Memphis Sand aquifer which lies below the shallow water bearing zone (separated by the Jackson Clay unit) is used as a potable water source for the Town of Collierville. Engineering controls (i.e. air stripper) are currently in place on the Collierville municipal well system to remove contaminants prior to distribution. As a result, actual current resident exposure to groundwater contaminants is negligible.

In light of the current and potential future groundwater uses, efforts should be made to preclude the migration of volatile contaminants from the shallow water bearing zone to the Memphis

TABLE 6-6
Current and Future Resident
Direct Ingestion and Inhalation Groundwater Pathway Risk
Carrier Site

Compound	SF_{oral} $(mg/kg\text{-}day)^{-1}$	$SF_{inhalation}$ $(mg/kg\text{-}day)^{-1}$	RfD (mg/kg-day)	Current Resident RME (ppm)	Future Resident RME (ppm)	Current Risk (Hazard Index)	Future Risk (Hazard Index)
TCE	0.011	0.017	NA	0.29	0.53	$4.7x10^{-4}$	$2.5x10^{-4}$
DCE	NA	NA	0.01	0[A]	0.117	NA	HI=0.33
DCA	0.091	0.091	NA	0[A]	0[A]	NA	NA
PCE	0.051	$1.1x10^{-10}$	0.01	0[A]	0[A]	NA	NA
Vinyl Chloride	1.9	$1.8x^{-6}$	NA	0[A]	0[A]	NA	NA
Lead	NA	NA	0.0004	0.045[B]	0.060[B]	HI=3.2	HI=4.1
Zinc	NA	NA	0.21	6.68	6.3	0.87	0.82
Upper Bound Sum of cancer risk: Current Residents = 2.5×10^{-4} Future Residents = 4.7×10^{-4}							
Upper Bound Sum of hazard indices Current Residents = 4.07 Future Residents = 5.3							

Notes:

NA = Not Applicable
RME = The highest exposure that is reasonable expected to occur at a Site.

[A] indicates that the compound was not identified in samples collected from the subject wells.

[B] not significantly elevated above background well concentrations (see Appendix P)

Cancer Risk Formula:

$$\text{Risk} = \frac{[\text{contaminant}] \times EF \times ED \times [(SF_i \times K \times IR_a) + (SF_o \times IR_w)]}{BW \times AT \times 365 \text{ days/year}}$$

Non-Carcinogenic Risk (Hazard Index) Formula:

$$\text{Hazard Index} = \frac{[\text{contaminant}] \times IR_w \times EF \times ED}{RfD_o \times BW \times AT \times 365 \text{ days/year}} + \frac{[\text{contaminant}] \times K \times IR_a \times EF \times ED}{RfD_i \times BW \times AT \times 365 \text{ days/year}}$$

Where:

BW = Body Weight = 70 kg; AT = Averaging Time = 70 years
EF = Exposure Frequency = 350 days/year; ED = Exposure Duration = 30 years
SF_i = Inhalation slope factor = chemical-specific; SF_o = Oral slope factor = chemical-specific
K = volatilization factor = 0.0005 x 1000 L/m^3; IR_a = daily indoor inhalation rate = 15 m^3/day
IR_w = daily water ingestion rate = 2 L/day; RfD_o = oral reference dose = chemical-specific
RfD_i = inhalation reference dose = chemical-specific
Risk (hazard index) formulae were obtained from USEPA's Risk Assessment Guidance for Superfund, Volume I, Parts A & B.

Sands in order to maintain (and over time enhance) the quality of the Memphis Sand aquifer.

6.5 Soil Cleanup Goals for Groundwater Protection

USEPA's Center for Environmental Assessment Modeling (CEAM) provided their Exposure Assessment Multimedia Model (MultiMed) for application at the Carrier A.C. Site. The model was used in conjunction with traditional contaminant mass partitioning formulae to determine the soil cleanup goals necessary for protection of Memphis Sands aquifer quality.[4] Based on Site-specific soil and hydrogeologic conditions, a soil cleanup goal of 533 μg/kg TCE was determined to be protective of the Memphis Sand aquifer. The goal is applicable to the contaminant source areas ("hot spots") previously discussed. Remedial efforts need only focus on a limited portion of the Site as soil contaminants are restricted to approximately 20% of the total Site area.

All discussions regarding MultiMed input variable selection, model outputs and soil cleanup goal calculations are provided in Appendix R of the RI.

6.6 Ecological Considerations

No U.S. Dept. of Interior or State of TDEC lands or federally listed endangered species of wildlife were identified at the Site. The nature of the Site is such that avian or terrestrial wildlife would not be drawn to the Site. A surface water quality assessment and a biological impact assessment were conducted. The assessments included a quantitative study of benthic species diversity in Nonconnah Creek, and a qualitative review of sensitive and endangered species typical of southeastern Shelby County. Data to date indicate no significant adverse ecological impacts from the present soil or groundwater contamination. This preliminary survey does not rule out ecological impacts to aquatic and terrestrial species through contaminated food chain mechanisms. However, TCE is not biocumulative and as a result, it is not expected to cause deleterious food chain effects based on currently available data.

6.7 Risk Uncertainty

There is a generally recognized uncertainty in human risk values developed from experimental data. This is primarily due to the uncertainty of data extrapolation in the areas of (1) high to low dose exposure, (2) modeling of dose response effects observed, (3) route to route extrapolation, and (4) animal data to human experience. The Site-specific uncertainty is mainly in the degree of accuracy of the exposure assumptions.

In the presence of such uncertainty, the USEPA and the risk assessor have the obligation to

---

[4]Contaminant partitioning equations from USEPA's *Determining Soil Response Action Levels Based on Potential Contaminant Migration to Groundwater: A Compendium of Examples*, USEPA, OERR, EPA/540/2/89/057, October 1989.

make conservative assumptions such that the chance is very small for the actual health risk to be greater than that determined through the risk process. On the other hand, the process is not to yield absurdly conservative risk values that have no basis in reality. That balance was kept in mind in the development of exposure assumptions and pathways and in the interpretation of data and guidance for this baseline risk assessment.

Actual or threatened releases of hazardous substances from this Site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment.

7.0 DESCRIPTION OF REMEDIAL ALTERNATIVES

The following remedial alternatives were selected for evaluation:

- Alternative 1: No-Action
- Alternative 2: North Remediation System (NRS); Groundwater Containment/Treatment at Water Plant 2
- Alternative 3: NRS and Plant Area Soil Vapor Extraction (SVE); Groundwater Containment/Treatment at Water Plant 2
- Alternative 4: NRS and Plant Area SVE; Groundwater Containment/Treatment at Water Plant 2, and Supplemental Extraction Well(s) via (a) Air Stripping, or (b) UV/Oxidation
- Alternative 5: Plant Area Soil Excavation/Low Temperature Thermal Desorption (LTTD), NRS and Plant Area SVE; Groundwater Containment/Treatment at Water Plant 2
- Alternative 6: Plant Area Soil Excavation/LTTD, NRS and Plant Area SVE; Groundwater Containment/Treatment at Water Plant 2, and Supplemental Extraction Well(s) via (a) Air Stripping, or (b) UV/Oxidation

Common Features of the Alternatives

Institutional Controls

All alternatives, except No Action, include institutional controls such as deed restrictions, local ordinances or record notices applied as appropriate for long-term management and prevention of exposure to contaminants.

Groundwater Residuals

Excluding No Action, all the alternatives generate a groundwater stream which must be discharged. The route of discharge may be release to the local POTW, surface water, the Town of Collierville water supply, or back to Site groundwater by reinjection. EPA will select the discharge route. The selection is subject to the ability of each alternative to meet ARARs, and is discussed in text describing each alternative.

Soils Residuals

Alternatives 5 and 6 require that soils be excavated prior to treatment. EPA will select the disposal route for the treated soils. Disposal may be offsite, or onsite, and subject to RCRA land disposal restrictions if the soils are hazardous waste. Delisting may be required if the soils are deemed RCRA-listed wastes, and onsite use as fill is chosen as the ultimate disposition. If offsite disposal is chosen, the waste must meet treatment standards prior to disposal in a permitted RCRA facility.

Site Monitoring

While wastes remain at the Carrier A.C. Site, CERCLA requires that monitoring data collected from the Site be evaluated every five years. This evaluation would include spatial and temporal analysis of existing data to determine increasing, decreasing, or stationary trends in contaminant concentrations. The results of this evaluation would be used to reassess the need to maintain, increase or decrease the number and types of samples and analysis required for monitoring, and the need to change the remedial response at the Site.

Existing Controls

The Town of Collierville's Water Plant No. 2 essentially contains groundwater contaminants in the Memphis Sand, and controls exposure to contaminants through treatment. The plant includes two extraction wells with 5-foot diameter air strippers (treatment capacity is 1.4 MGD) to remove TCE and other VOCs from groundwater to a level below 1 $\mu g/\ell$. In order for this treatment system to contain groundwater contaminants, the Town of Collierville wells must pump without interruption.

In addition to the Memphis Sand groundwater containment and treatment afforded by continued operation of Water Plant 2, a remediation system is in place, as a result of the treatability study, at the former lagoon, referred to as the North Remediation System (NRS). This equipment was installed to dewater and extract Site contaminants from soils impacted by the former lagoon by soil vapor extraction (SVE).

In the following alternative descriptions, although all constituents of concern must be considered, TCE will drive remedial efforts. Lead in Memphis Sand groundwater poses significant potential acute health risk in the worst-case scenarios presented in the Baseline Risk Assessment.

Elevated lead levels have not been observed routinely in the Memphis Sand groundwater at Water Plant 2, nor anywhere in the Collierville drinking water system. For this reason the following proposed remedial alternatives do not explicitly include lead removal actions. This in no way changes the need for alternatives to comply with ARARs, including chemical-specific requirements for metals.

7.1 Alternative 1: No Action

CERCLA requires that the "No Action" alternative be considered at every site against which the other alternatives are evaluated. Under this alternative no action would be taken. Operation of the two air strippers at Water Plant 2 and the NRS would be discontinued.

The only reduction of contaminant levels in Site soils and groundwater would occur through natural processes. The time for groundwater levels to drop below SDWA regulations is on the order of 2000 years. This alternative leaves the volume of hazardous substances unchanged, and the potential increase in volume of impacted environmental media - groundwater. Without treatment or containment, residual upper-bound risk associated with groundwater exposure is in the range 2.5×10^{-4} to 4.7×10^{-4}.

Selected Site groundwater monitoring wells and soil spaces would be sampled for volatile organic compounds and metals. Because contaminated soils and groundwater would remain in place, untreated, at the Site, CERCLA requires that data be collected and evaluated at least every five years to assure that a selected remedy continues to be protective of human health and the environment. Based upon the findings of the review, EPA may determine other studies and/or actions should be taken.

This alternative would not comply with the Safe Drinking Water Act (SDWA) regulations or EPA's Groundwater Protection Strategy.

This alternative has no capital costs. The approximate costs for the monitoring program is $410,000 per five year sampling event, and $50,000 annually for quarterly groundwater sampling and analysis, yielding an approximate present worth from $1,437,223 to $2,180,152. The present worth analysis is based upon a 30-year life and a 5 percent discount rate.

7.2 Alternative 2: North Remediation System (NRS); Groundwater Containment/Treatment at Water Plant 2

The major features of this alternative include soil vapor extraction in the former lagoon area, also referred to as the North Remediation System (NRS). Approximately 8500 cubic yards of TCE and its degradation products would be addressed by the NRS. Also, the town wells at Water Plant 2 would continue to operate to provide containment and treatment (air stripping) of Memphis Sands groundwater contaminated with TCE and its degradation products.

Modeling runs and indications from RI data point toward the conclusion that operation of the

town well field has essentially contained the plume. This information is not conclusive and thus makes any assessment of overall protection somewhat uncertain, until additional Memphis Sands aquifer testing is performed duirng Remedial Design (RD). Also, contamination will continue to enter the Memphis Sand aquifer at the southern end of the Site and will remain in the Sand for some years until extracted at Water Plant 2.

The amount of contaminated soils that would be treated in the lagoon area was determined using fate and transport modeling to estimate the potential groundwater contamination. Transport modeling calculations indicate that at an average concentration of about 533 μg/kg TCE at the existing source areas would no longer yield leachate which would contaminate Memphis Sand groundwater above 5 $\mu g/\ell$ for TCE. Approximately 68,000 cubic yards of contaminated soils which are a significant source of current and potential future contamination of the Memphis Sand aquifer would be left untreated. Although some native microbial degradation has occurred, it is not likely that natural attenuation will reduce residual TCE contamination to the level estimated to be protective of the Memphis Sand in a timely manner (over a period on the order of 2000 years).

The treated water from the air strippers would remain a significant supply for the Town of Collierville. Both air stripping and SVE volatilize contaminants to an air stream. Due to the low volumes of air emissions, no off-gas controls would be necessary.

The Memphis Sands groundwater would eventually be treated to levels below SDWA regulations, but would not comply with the EPA's Groundwater Protection Strategy. This alternative would comply with federal and state Clean Air Act (CAA) standards.

Selected Site groundwater monitoring wells and soil would be sampled for volatile organic compounds and metals. A review of data collected at the Site would be evaluated at least every five years during the remedial action or until contaminant concentrations in groundwater no longer exceed SDWA regulations or soil cleanup levels. The evaluation would continue until completion of the groundwater remedial action and would serve to indicate whether cleanup levels have been or will be attained. Based upon the findings of the review, EPA may determine other studies and/or actions should be taken.

The estimated capital cost of Alternative 2 is in the range of $1,052,935 to $1,133,199 while the associated Operations & Maintenance (O&M) and monitoring costs is $2,931,647. The estimated present worth cost is in the range $2,968,754 to $4,064,847. The estimated present worth analysis is based upon a 30-year life and a 5% discount rate.

7.3 Alternative 3: NRS and Plant Area Soil Vapor Extraction (SVE); Groundwater Containment/Treatment at Water Plant 2

This alternative treats TCE contaminated soil by soil vapor extraction at both the former lagoon area and the plant spill areas (volumes of approximately 8,500 cubic yards, and 68,000 cubic yards, respectively) and continued operation of Water Plant 2 affords containment and treatment

(air stripping) of the Memphis Sand groundwater.

Modeling runs and indications from RI data point toward the conclusion that operation of the Town well field has essentially contained the TCE plume. This information is not conclusive and thus makes any assessment of overall protection somewhat uncertain, until additional Memphis Sands aquifer testing is performed during RD. Also, TCE will continue to enter the Memphis Sand aquifer at the southern end of the Site until the Plant Area SVE is implemented, and will remain in the Memphis Sand until extracted at Water Plant 2. Containment at Water Plant 2 would be continued up to 30 years.

The locations and number of SVE wells in the main plant area depends upon the areal extent of contamination, area of influence produced by each well, and the variability in pneumatic permeability around the plant area. Some pilot-scale treatability work would likely be needed to complete the design of SVE implementation near the manufacturing plant.

The amount of contaminated soils that would be treated in the lagoon and main plant areas was determined using fate and transport modeling to estimate the potential groundwater contamination. Transport modeling calculations indicate that an average concentration of 533 $\mu g/kg$ TCE at the existing source areas will no longer yield leachate which would contaminate Memphis Sand groundwater above 5 $\mu g/\ell$ for TCE. Long-term benefits of this alternative would include permanent reduction in toxicity and volume of soil contamination. The estimated time for SVE to remediate the lagoon and main plant areas is three to five years.

The treated water from the air strippers would remain a significant supply for the Town of Collierville. Both air stripping and SVE volatilize contaminants to an air stream. Vapor-phase Granular Activated Carbon (GAC), thermal treatment, or photolytic oxidation would be used to control off-gas emissions if during Remedial Design/Remedial Action (RD/RA) it is determined necessary. Photolytic oxidation, although promising, is a relatively new technology and would require a pilot-scale treatability study.

The Memphis Sands groundwater would be treated to levels below SDWA regulations. This alternative would comply with federal and state CAA standards. All activities would comply with Occupational Safety and Health Act (OSHA) health and safety requirements. A small portion of the Site is situated in a 100-year floodplain and wetlands area. Any remedial activity or construction in the floodplain and wetland areas would comply with the Clean Water Act (CWA) Wetlands Regulations and the Wetlands Protection and Floodplain Management Policies. Also, Resource Conservation and Recovery Act (RCRA) Subtitle C and Department of Transportation (DOT) requirements for hazardous waste generation, transportation, storage, and disposal of hazardous waste would be applicable for this alternative. Hazardous waste soils from drilling, and spent GAC, if used, would be stored and transported to approved disposal facilities in accordance with RCRA Subtitle C and DOT requirements.

Selected Site groundwater monitoring wells and soil would be sampled for volatile organic compounds and metals. A review of data collected at the Site would be evaluated at least every

five years during the remedial action or until contaminant concentrations in groundwater no longer exceed SDWA regulations or soil cleanup levels. The evaluation would continue until completion of the groundwater remedial action and would serve to indicate whether cleanup levels have been or would be attained. Based upon the findings of the review, EPA may determine other studies and/or actions should be taken.

The estimated capital cost for this alternative is in the range of $1,742,400 to $2,102,512 while the associated costs for O&M and monitoring are $5,349,263. The estimated present worth costs are in the range $5,468,140 to $7,451,775. The estimated present-worth analysis is based upon a 30-year life and a 5% discount rate.

7.4 Alternative 4: NRS and Plant Area SVE; Groundwater Containment/Treatment at Water Plant 2, and Supplemental Extraction Well(s)/Treatment via (A) Air Stripping, or (B) UV/Oxidation

This alternative includes remediation of TCE contaminated soil by SVE in the former lagoon (NRS) and plant spill areas. Approximately 76,500 cubic yards of contaminated soils would be treated. Also included would be groundwater containment, treatment (air stripping), and disposal. The groundwater containment currently provided by the operation of Water Plant 2 extraction wells would be supplemented by additional extraction well(s).

Alternative 4 differs from alternative 3 in the manner that groundwater containment will have greater assurance. Groundwater in the Memphis Sand would continue to receive TCE contamination until the SVE could be implemented. The supplemental groundwater extractions included with this alternative would minimize the extent of Memphis Sand degradation that occurs in this interim period. Groundwater actions are expected to be effective, although additional information must be obtained during Remedial Design (RD) to determine the configuration and number of supplemental extraction wells required to meet effectiveness levels.

The fact that additionally-extracted groundwater will require treatment opens the following two treatment options: (A) air stripping and (B) innovative UV/oxidation. Operation of the air stripping system at Water Plant 2 will continue. An additional treatment unit will be required under this scenario to handle the added water from the supplemental extraction.

The locations and number of SVE wells in the main plant area depends upon the areal extent of contamination, area of influence produced by each well, and the variability in pneumatic permeability around the plant area. Some pilot-scale treatability work would be needed to complete the design of SVE implementation near the manufacturing plant.

The amount of contaminated soils that would be treated in the lagoon and main plant areas was determined using fate and transport modeling to estimate the potential groundwater contamination. Transport modeling calculations indicate that an average soil concentration of 533 μg/kg TCE at the existing source areas will no longer yield leachate which would

contaminate Memphis Sand groundwater above 5 $\mu g/\ell$ for TCE. Long-term benefits of this alternative would include permanent reduction in toxicity and volume of soil contamination. The estimated time for SVE to remediate the lagoon and main plant areas is three to five years.

The treated water from the supplemental extraction well(s) will be released to surface water, reinjected to the Memphis Sand, or distributed to the Town of Collierville drinking water supply as with Water Plant 2. The Town of Collierville Public Works has stated a preference for the use of treated water as an additional drinking water supply, because Collierville's water demand is increasing along with its population.

Both air stripping and SVE volatilize contaminants to an air stream. Vapor-phase Granular Activated Carbon (GAC), thermal treatment, or photolytic oxidation would be used to control off-gas emissions if during Remedial Design/Remedial Action (RD/RA) it is determined necessary. Photolytic oxidation, although promising, is a relatively new technology and would require a pilot-scale treatability study. UV/oxidation does not require air pollution control equipment or associated testing. Bench-scale testing would be required prior to UV/oxidation design to determine optimum operating parameters.

The Memphis Sands groundwater would be treated to levels below SDWA regulations, CWA Discharge Limitations and Pretreatment Standards, CWA Wetlands Regulations, SDWA Underground Injection Control Program, and/or the Tennessee Water Quality Act. This alternative would comply with federal and state CAA standards. All activities would comply with OSHA health and safety requirements. A small portion of the site is situated in a 100-year floodplain and wetlands area. Any remedial activity or construction in the floodplain and wetland areas would comply with the CWA Wetlands Regulations and the Wetlands Protection and Floodplain Management Policies. Also, RCRA Subtitle C and DOT requirements for hazardous waste generation, transportation, storage, and disposal of hazardous waste would be applicable for this alternative. Hazardous waste soils from drilling, and spent GAC, if used, would be stored and transported to approved disposal facilities in accordance with RCRA Subtitle C and DOT requirements.

Selected Site groundwater monitoring wells and soil would be sampled for volatile organic compounds and metals. A review of data collected at the Site would be evaluated at least every five years during the remedial action or until contaminant concentrations in groundwater no longer exceed SDWA regulations or soil cleanup levels. The evaluation would continue until completion of the groundwater remedial action and would serve to indicate whether cleanup levels have been or would be attained. Based upon the findings of the review, EPA may determine that other studies and/or actions should be taken.

The estimated capital cost for Alternative 4(A) is in the range of $1,900,260 to $2,443,431 while the associated costs for O&M and monitoring are $5,489,334. The estimated present worth costs are in the range $5,717,755 to $7,932,765.

The estimated capital cost for Alternative 4(B) is in the range of $2,007,540 to $2,578,163 while

the associated costs for O&M and monitoring are $5,839,513. The estimated present worth costs are in the range $6,054,423 to $8,417,675.

The estimated present-worth analyses is based upon a 30-year life and a 5% discount rate.

7.5 Alternative 5: Plant Area Soil Excavation/Low Temperature Thermal Desorption (LTTD), NRS and Plant Area SVE; Groundwater Containment/Treatment at Water Plant 2

Alternative 5 includes excavation, low temperature thermal desorption (LTTD) and SVE for source remediation. Shallow source area soils (approximately 52,000 cubic yards contaminated with TCE at greater than the 533 μg/kg threshold for protection of Memphis Sand groundwater) would be excavated and backfilled with clean native soil. SVE would then be used to remediate deeper contamination where excavation of about 16,300 cubic yards is less readily implemented, and permeability is expected to be greater than in the lagoon area. The NRS would also be operated to reach soil remedial levels at the former lagoon source area, involving about 8500 cubic yards, the top 15 feet of which may be excavated and processed by LTTD, if needed.

Water Plant 2 operation would continue to contain and treat (air stripping) contaminated groundwater. Modeling runs and indications from RI data point toward the conclusion that operation of the Town well field has essentially contained the TCE plume. This information is not conclusive and thus makes any assessment of overall protection somewhat uncertain, until additional Memphis Sands aquifer testing is performed. Also, TCE will continue to enter the Memphis Sand aquifer at the southern end of the Site until the Plant Area SVE is implemented, and will remain in the Memphis Sand until extracted at Water Plant 2. Containment at Water Plant 2 would be continued for up to 30 years.

All soil contaminated above 533 μg/kg TCE would be excavated to a depth of approximately 15 feet, sampled, analyzed and stockpiled for LTTD processing. After soil excavation is completed and the cells are backfilled with clean native soil, SVE will be implemented to remediate soils which exceed the soil cleanup level at depths greater than 15 feet.

Effectiveness of excavation and LTTD is expected to be very high for the source soils. LTTD off-gas would be treated with a cyclone separator, a baghouse, and an afterburner. The afterburner would be located either upstream or downstream of the baghouse.

The locations and number of SVE wells in the lagoon and main plant areas depend upon the areal extent of contamination, area of influence produced by each well, and the variability in pneumatic permeability around the plant area. Some pilot-scale treatability work would likely be needed to complete the design of SVE implementation near the manufacturing plant.

The amount of contaminated soils that would be treated in the lagoon and main plant areas was determined using fate and transport modeling to estimate the potential groundwater contamination. Transport modeling calculations indicate that an average concentration of

533 μg/kg TCE at the existing source areas would no longer yield leachate which would contaminate Memphis Sand groundwater above 5 $\mu g/\ell$ for TCE. Long-term benefits of this alternative would include permanent reduction in toxicity and volume of soil contamination. The estimated time for LTTD and SVE to remediate the lagoon and main plant areas is two to three years.

The treated water from the air strippers would remain a significant supply for the Town of Collierville. Both air stripping and SVE volatilize contaminants to an air stream. Vapor-phase Granular Activated Carbon (GAC), thermal treatment, or photolytic oxidation would be used to control off-gas emissions if during RD/RA it is determined necessary. Photolytic oxidation, although promising, is a relatively new technology and would require a pilot-scale treatability study.

The Memphis Sands groundwater would be treated to levels below SDWA regulations. This alternative would comply with federal and state CAA standards. All activities would comply with OSHA health and safety requirements. A small portion of the site is situated in a 100-year floodplain and wetlands area. Any remedial activity or construction in the floodplain and wetland areas would comply with the CWA Wetlands Regulations and the Wetlands Protection and Floodplain Management Policies. Also, RCRA Subtitle C and DOT requirements for hazardous waste generation, transportation, storage, and disposal of hazardous waste would be applicable for this alternative. Hazardous waste soils from drilling, and if used, spent GAC, would be stored and transported to approved disposal facilities in accordance with RCRA Subtitle C and DOT requirements.

Selected Site groundwater monitoring wells and soil spaces would be sampled for volatile organic compounds and metals. A review of data collected at the Site would be evaluated at least every five years during the remedial action or until contaminant concentrations in groundwater no longer exceed SDWA MCLs and/or MCLGs or soil cleanup levels. The evaluation would continue until completion of the groundwater remedial action and would serve to indicate whether cleanup levels have been or will be attained. Based upon the findings of the review, EPA may determine that other studies and/or actions should be taken.

The estimated capital cost for this alternative is in the range of $5,688,540 to $8,579,136 while the associated costs for O&M and monitoring are $5,437,347. The estimated present worth costs are in the range $9,467,667 to $13,956,482. The estimated present-worth analysis is based upon a 30-year life and a 5% discount rate.

7.6 Alternative 6: Plant Area Soil Excavation/LTTD, NRS and Plant Area SVE; Groundwater Containment/Treatment at Water Plant 2, and Supplemental Extraction Well(s)/Treatment via (A) Air Stripping, or (B) UV/Oxidation

Alternative 6 includes excavation and low temperature thermal desorption (LTTD) and SVE for source remediation. Shallow source area soils (approximately 52,000 cubic yards contaminated with TCE at greater than the 533 μg/kg threshold for protection of Memphis Sand groundwater)

would be excavated and backfilled with clean native soil. SVE would then be used to remediate deeper contamination where excavation of about 16,300 cubic yards is less readily implemented, and permeability is expected to be greater than in the lagoon area. The NRS would also be operated to reach soil remediation levels at the former lagoon source area, involving about 8500 cubic yards, the top 15 feet of which may be excavated and processed by LTTD, if needed.

All soil contaminated above 533 μg/kg TCE would be excavated to a depth of approximately 15 feet, sampled, analyzed and stockpiled for LTTD processing. After soil excavation is completed and the cells are backfilled with clean native soil, SVE will be implemented to remediate soils which exceed the soil cleanup level at depths greater than 15 feet.

Effectiveness of excavation and LTTD is expected to be very high for the source soils. Off-gas would be treated with a cyclone separator, a baghouse, and an afterburner. The afterburner would be located either upstream or downstream of the baghouse.

The locations and number of SVE wells in the lagoon and main plant areas depend upon the areal extent of contamination, the area of influence produced by each well, and the variability in pneumatic permeability around the plant area. Some pilot-scale treatability work would likely be needed to complete the design of SVE implementation near the manufacturing plant.

The amount of contaminated soils that would be treated in the lagoon and main plant areas was determined using fate and transport modeling to estimate the potential groundwater contamination. Transport modeling calculations indicate that an average concentration of 533 μg/kg TCE at the existing source areas would no longer yield leachate which would contaminate Memphis Sand groundwater above 5 μg/ℓ for TCE. Long-term benefits of this alternative would include permanent reduction in toxicity and volume of soil contamination. The estimated time for LTTD SVE to remediate the lagoon and main plant areas is two to three years.

Alternative 6 differs from Alternative 5 in the manner that groundwater containment will have greater assurance. Groundwater in the Memphis Sand would continue to receive TCE contamination until the SVE could be implemented. The supplemental groundwater extraction wells included with this alternative would minimize the extent of Memphis Sand degradation that occurs in this interim period. Groundwater actions are expected to be effective, although additional information must be obtained during RD to determine the configuration and number of supplemental extraction wells required to meet effectiveness levels.

The fact that additionally-extracted groundwater will require treatment opens the following two treatment options: (A) air stripping and (B) innovative UV/oxidation. Operation of the air stripping system at Water Plant 2 would continue. An additional treatment unit would be required under this scenario to handle the added water from the supplemental extraction.

The treated water from the supplemental extraction well(s) would be released to surface water, reinjected to the Memphis Sand, or distributed to the Town of Collierville drinking water supply

as with Water Plant 2. The Town of Collierville Public Works has stated a preference for the use of treated water as an additional drinking water supply, because Collierville's water demand is increasing along with its population.

Both air stripping and SVE volatilize contaminants to an air stream. Vapor-phase Granular Activated Carbon (GAC), thermal treatment, or photolytic oxidation would be used to control off-gas emissions if during Remedial Design/Remedial Action (RD/RA) it is determined necessary. Photolytic oxidation, although promising, is a relatively new technology and would require a pilot-scale treatability study. UV/oxidation does not require air pollution control equipment or associated testing. Bench-scale testing would be required prior to UV/oxidation design to determine optimum operating parameters.

The Memphis Sands groundwater would be treated to levels below SDWA regulations, CWA Discharge Limitations and Pretreatment Standards, CWA Wetlands Regulations, SDWA Underground Injection Control Program, and/or the Tennessee Water Quality Act. This alternative would comply with federal and state CAA standards. All activities would comply with OSHA health and safety requirements. A small portion of the site is situated in a 100-year floodplain and wetlands area. Any remedial activity or construction in the floodplain and wetland areas would comply with the CWA Wetlands Regulations and the Wetlands Protection and Floodplain Management Policies. Also, RCRA Subtitle C and DOT requirements for hazardous waste generation, transportation, storage, and disposal of hazardous would be applicable for this alternative. Hazardous waste soils from drilling, and if used, spent GAC, would be stored and transported to approved disposal facilities in accordance with RCRA Subtitle C and DOT requirements.

Selected Site groundwater monitoring wells and soil would be sampled for volatile organic compounds and metals. A review of data collected at the Site would be evaluated at least every five years during the remedial action or until contaminant concentrations in groundwater no longer exceed SDWA regulations or soil cleanup levels. The evaluation would continue until completion of the groundwater remedial action and would serve to indicate whether cleanup levels have been or will be attained. Based upon the findings of the review, EPA may determine that other studies and/or actions should be taken.

The estimated capital cost for Alternative 6(A) is in the range of $5,917,734 to $8,931,088 while the associated costs for O&M and monitoring are $5,577,418. The estimated present worth costs are in the range $9,788,616 to $14,508,506.

The estimated capital cost for Alternative 6(B) is in the range of $5,913,909 to $8,923,438 while the associated costs for O&M and monitoring are $5,927,597. The estimated present worth costs are in the range $10,014,179 to $14,851,035.

The estimated present-worth analyses is based upon a 30-year life and a 5% discount rate.

8.0 SUMMARY OF COMPARATIVE ANALYSIS OF ALTERNATIVES

A detailed comparative analysis was performed on the six remedial alternatives developed during the FS and the modifications submitted during the public comment period using the nine evaluation criteria set forth in the NCP. The advantages and disadvantages were compared to identify the alternative with the best balance among these nine criteria.

Overall Protection of Human Health and the Environment addresses whether or not a remedy provides adequate protection and describes how risks are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls. Criteria used to evaluate the protectiveness of an alternative included the following: (1) no cancer risks from exposure to groundwater of less than $1x10^{-6}$; (2) no significant risks of threshold toxic effect (HI less than 1) under reasonable maximum exposure; and (3) no significant risk or adverse effects on the environment.

All alternatives except for "No Action", would be protective of human health. The "No Action" alternative is not protective because it would not prevent unacceptable risk from ingestion or inhalation of groundwater.

"No Action" and Alternative 2 are not protective of the environment because they allow for contamination to continue to enter the Memphis Sands. The effectiveness of the existing Water Plant 2 well system in containing the entire plume is the key factor which differentiates alternatives 3 and 5 from 4 and 6. If the southwestern extent of the plume of TCE (concentrations greater than MCLs) which arises from the plant area spills is outside the capture zone of Plant 2 wells, protectiveness is not assured. Thus, Alternatives 3 and 5 would not fully protect the environment. Alternatives 4 and 6 would provide additional certainty that existing groundwater contamination would be contained.

Since the "No-Action" alternative does not eliminate, reduce or control any of the exposure pathways, it is therefore not protective of human health or the environment and will not be considered further in this analysis. Alternative 2 will not be discussed further because it is not protective of the environment. This alternative only addresses the soils in the vicinity of the former lagoon area and without response directed toward source soils near the main plant, these sources will be remediated only by natural attenuation over a period on the order of 2000 years, not accounting for biological degradation. Without more rapid source control, restoration of the Memphis Sand cannot be accomplished in a timely manner.

Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) addresses whether or not a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and state environmental statutes and/or provide grounds for a waiver. The identified ARARs for this site are listed in Section 10.2.

Alternatives 3,4,5, and 6 would comply with Federal and state ARARs.

Long-Term Effectiveness and Permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once cleanup levels have been met. This criterion includes the consideration of residual risk and the adequacy and reliability of controls.

Alternatives 4 and 6 afford the highest degree of long-term effectiveness because all contaminated soils would be reduced to levels protective of the Memphis Sand aquifer; the remedial action objective of preventing further contamination to the Memphis Sands is quickly achieved through implementation of additional extraction well(s); and the additional well(s) will provide assurance that containment of the entire contaminant plume is adequate. Although Alternatives 3 and 5 reduce contaminated soil to levels protective of the Memphis Sands, these alternatives do not assure quick prevention of further contamination of the Memphis Sands or containment of the entire plume.

Reduction of Toxicity, Mobility, or Volume Through Treatment refers to the anticipated performance of the treatment technologies a remedy may employ.

Alternatives 3,4,5, and 6 would accomplish a reduction in toxicity, mobility, and volume. The alternatives would reduce toxicity by volatilization of TCE from soil and groundwater. Mobility would be reduced as residual TCE is extracted (all alternatives) and/or excavated (5 and 6) from soils. As soon as treatment of vadose zone soils is complete, migration of toxic concentration levels of TCE in groundwater would cease. The volume of TCE in groundwater and some contaminated soils would be reduced as the treatment progresses. Essentially the entire volume of contaminated site soils would be treated by SVE (Alternatives 3,4,5, and 6) and/or LTTD (5 and 6) —— totalling over 76,000 cubic yards. Alternatives 3,4,5, and 6 provide for destruction of air emission residuals through properly selected, designed and operated emission controls.

Alternative 4 and 6 would extract and treat all affected Memphis Sand groundwater. Alternatives 3 and 5 would capture most of the contaminated groundwater plume at Water Plant 2.

Short-Term Effectiveness refers to the period of time needed to complete the remedy and any adverse impacts on human health and the environment that may be posed during the construction and implementation of the remedy until cleanup levels are achieved.

Short-term risk from Alternatives 5 and 6 are higher than those associated with Alternatives 3 and 4 because excavation activities would increase VOCs and fugitive dust emissions. A water or foam spray would reduce emissions enough to substantially mimimize the risk to the community.

Alternatives 5 and 6 would require approximately two to three years to remediate Site soils to levels protective of the Memphis Sands. Alternatives 3 and 4 would require three to five years to remediate Site soils to levels protective of the Memphis Sands. All the alternatives would require approximately 30 years to remediate groundwater to ARARs.

For all alternatives, risk to onsite workers would be minimized by providing personal protection equipment as outlined by OSHA. The alternatives protect the community and workers by reducing the contaminants in soil, groundwater, and air (through the use of emission controls on discharge pipes at the SVE, and air stripper systems). UV/oxidation generates no air emissions. No additional adverse impact to the environment would occur from the implementation of these alternatives.

Implementability is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement the chosen solution.

Groundwater containment/air stripping (3, 4A, 5, and 6A) measures are extremely common and widely available. Monitoring groundwater and its restoration should not pose extraordinary problems.

SVE (all alternatives) and LTTD (5 and 6) are relatively new, yet widely available technologies for the treatment of volatile organic contaminated soils. A treatability study for SVE at the main plant area would be required to effectively address what are expected to be heterogeneous spaces in terms of both contamination and air permeability. The ability to monitor effectiveness of SVE is not technically infeasible, but would require carefully designed and implemented sampling efforts to assure effectiveness in reaching soil cleanup levels.

UV/oxidation (4A and 6A) is less common at hazardous waste sites, but is a demonstrated process for streams with low contaminant concentrations, and low total solids content. Supplementally-extracted groundwater may pose operation problems, such as fouling, or high oxidant consumption, due to the presence of trace metals and hardness. UV/oxidation treatability work would be required before design to avoid or manage potential operational problems.

Cost

The total Present Worth Costs for each of the alternatives evaluated are as follows:

Alternative 3: $5.5 to $7.5 million
Alternative 4A: $5.7 to $7.9 million
Alternative 4B: $6.1 to $8.4 million
Alternative 5: $9.5 to $14 million
Alternative 6A: $9.8 to $14.5 million
Alternative 6B: $10 to $14.9 million

State Acceptance

EPA and the Tennessee Department of Environment and Conservation (TDEC) have cooperated throughout the RI/FS process. The State has participated in the development of the RI/FS through comment on each of the planning and decision documents developed by EPA, and the

Draft ROD and through frequent contact between the EPA and TDEC site project managers. EPA and TDEC are in agreement on the selected alternative. Please refer to the Responsiveness Summary which contains a letter of concurrence from TDEC.

Community Acceptance

EPA received two letters from residents in the Town of Collierville. During the public meeting held on April 30, 1992, town residents in attendance expressed interest and support for the selected remedy present by EPA. Please see the Responsiveness Summary which contains these letters and a transcript of the public meeting.

9.0 THE SELECTED REMEDY

Based upon consideration of the CERCLA requirements, the detailed analysis of the alternatives using the nine criteria, and public comments, both EPA and TDEC have determined that Alternative 4A is the most appropriate remedy for the Carrier A.C. Superfund Site in Collierville, Tennessee.

The selected remedy shall include the following: (1) the North Remediation System (NRS) and plant area soil vapor extraction (SVE); (2) groundwater containment/treatment at Water Plant 2, and supplemental extraction well(s)/treatment via air stripping; and (3) institutional controls placed on well construction and water use in the general area of the Site.

It is estimated that the present worth cost of the selected remedy will be approximately $5.7 to $7.9 million. The present worth cost analysis is based upon a 30-year life and a 5% discount rate.

Alternative 4A will permanently reduce the risk of exposure to contaminants in soil and groundwater and will also prevent further contamination to the environment.

9.1 Performance Standards

(1) North Remediation System (NRS) and Plant Area Soil Vapor Extraction (SVE)

The NRS shall continue to remediate the contaminated soils in the area of the former lagoon via SVE. A SVE system in the area of the main plant source area shall be constructed to remediate contaminated soils. SVE in the former lagoon and main plant area will continue to operate until remediation to cleanup levels are reached throughout the area of soil contamination. The cleanup level for the TCE-contaminated soil will be approximately 533 μg/kg or until in EPA's determination, it is demonstrated that contaminant levels have ceased to decline over time, and are remaining constant at some statistically significant level above remediation levels in the area of remediation, as verified by soil sampling. The ability to achieve 533 μg/kg cannot be determined until after the extraction system has been implemented, modified as necessary, and

soil response monitored over time. A monitoring system will be instituted to measure progress and operating efficiencies of SVE in achieving the cleanup level.

EPA will determine the locations and number of vapor extraction wells in the main plant area. The decisions will be based upon the areal extent of contamination, area of influence produced by each well, and the variability in pneumatic permeability around the plant area. Some pilot-scale treatability work will be needed to complete the design of SVE implementation near the manufacturing plant.

All air emissions shall be in compliance with the Federal and State CAA standards. Off-gas emissions, if determined necessary during RD, will be controlled by Granular Activated Carbon (GAC), thermal treatment, or photolytic oxidation.

(2) Groundwater Containment/Treatment at Water Plant 2, and Supplemental Extraction Well(s)/Treatment via Air Stripping

Groundwater Containment/Treatment shall be conducted at Water Plant 2 and with supplemental well(s). EPA will determine the final number and location of supplemental wells for the Site. The existing air strippers at Water Plant 2 shall continue to be used to treat extracted groundwater. If EPA deems necessary, additional air strippers and/or monitoring wells will be installed as part of the remedial action to ensure compliance with the cleanup levels of the selected remedy.

The groundwater extraction system will continue to operate until cleanup levels for the contaminants of concern are reached throughout the area of attainment. The area of attainment shall encompass the area up to the contaminant plume boundary.

The Memphis Sand aquifer will be treated until the cleanup levels for the contaminants, as listed below, are attained.

Trichloroethylene (TCE)	5 $\mu g/\ell$ (SDWA MCL)
cis-1,2-Dichloroethylene (DCE)	70 $\mu g/\ell$ (SDWA MCLG)
trans-1,2-Dichloroethylene (DCE)	100 $\mu g/\ell$ (SDWA MCLG)
Tetrachloroethene (PCE)	5 $\mu g/\ell$ (SDWA MCL)
Vinyl Chloride	2 $\mu g/\ell$ (SDWA MCL)
Zinc	5000 $\mu g/\ell$ (SDWA SMCL)

The Memphis Sand aquifer will be treated until (1) background levels of lead or (2) cleanup levels for lead of 15 $\mu g/\ell$ (SDWA Treatment Technique Action Level) is attained. The determination of which level will be achieved will be based upon whether lead is elevated above background levels and this condition is due to Site-related conditions; or whether a significant statistical difference between background levels and onsite levels of lead exists.

The accepted EPA methods are documented in the "USEPA Contract Lab Program Statement

of Work for Inorganic Analysis, Document #ILM02.0"; the "Contract Lab Program Statement of Work for Organic Analysis, Document # OLM01.0," dated August 1991; and the "Superfund Analytical Methods for Low Concentration Water for Organic Analysis," dated June 1991, and any amendments made thereto during the course of the implementation of RD/RA. Monitoring wells shall be sampled for up to 30 years.

The sampling frequency, number, and location of the monitoring wells and background monitoring wells will be designated by EPA during the RD, and if deemed necessary, additional monitoring wells will be installed.

The goal of this remedial action is to restore the Memphis Sands groundwater to its beneficial use, which is, at this Site, a drinking water aquifer. Based on information obtained during the RI and on a careful analysis of all remedial alternatives, EPA and TDEC believe that the selected remedy will achieve this goal. It may become apparent, during implementation or operation of the groundwater extraction systems, that contaminant levels have ceased to decline and are remaining constant at levels higher than the remediation levels. In such a case, the system performance standards and/or remedy will be reevaluated.

The selected remedy will include groundwater extraction for an estimated period of 30 years, during which the system's performance will be carefully monitored on a regular basis and adjusted as warranted by the performance data collected during operation. The operating system may include:

a) discontinuing operation of extraction wells in areas where cleanup levels have been attained;

b) alternating pumping at wells to eliminate stagnation points; and

c) pulse pumping to allow aquifer equilibration and encourage adsorbed contaminants to partition into groundwater.

To ensure that cleanup levels continue to be maintained, the aquifer will be monitored at those wells where pumping has ceased on an occurrence of at least every 5 years following discontinuation of groundwater extraction.

All extracted groundwater shall be treated to levels which allow for discharge to (1) the municipal water supply; (2) a local POTW; (3) surface water; or (4) reinjected to the Memphis Sands aquifer. All groundwater discharge actions shall comply with Federal and State discharge requirements.

All air emissions from the air stripper(s) shall be in compliance with Federal and State CAA standards. Off-gas emissions, if determined necessary during RD, will be controlled by Granular Activated Carbon (GAC), thermal treatment, or photolytic oxidation.

(3) Institutional Controls Placed on Well Construction and Water Use in the General Area of the Site

If EPA deems necessary, institutional controls will be placed on well construction in the general area of the Site. No well will be located, constructed or operated which results in the diminution of the extraction wells at Carrier A.C. Superfund Site or in the degradation of the Memphis Sands. Institutional controls will also restrict the use of groundwater containing, or potentially containing, levels of contamination in excess of MCLs, SMCLs and non-zero MCLGs. Institutional controls may include local ordinances, deed restrictions, record notice, or some other appropriate measures. The controls shall remain in effect until EPA through monitoring determines that the cleanup levels have been attained.

10.0 STATUTORY DETERMINATIONS

Under CERCLA Section 121, EPA must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a statutory waiver is justified), are cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduce the volume, toxicity, or mobility or hazardous wastes as their principal element. The following sections discuss how the remedy meets these statutory requirements.

10.1 Protection of Human Health and the Environment

The selected remedy protects human health and the environment through the North Remediation System (NRS) and plant area soil vapor extraction (SVE); groundwater containment/treatment at Water Plant 2, and supplemental extraction well(s)/treatment via air stripping; and institutional controls placed on well construction and water use in the general area of the Site. Air stripping will irreversibly remove organic compounds from groundwater. SVE will irreversibly remove VOCs from soils to levels at or below soil cleanup levels. Residuals in air emissions will be controlled through properly selected, designed and operated emission controls. Institutional controls will assure that the public is not affected by Site-related contaminants at a current or future time.

Air stripping of contaminated groundwater will eliminate the threat of exposure to the contaminants of concern via ingestion or inhalation of groundwater. The current cancer risk associated with this exposure pathway is 2.5×10^{-4}. The future cancer risk from the groundwater pathway is 4.7×10^{-4}. By extracting and air stripping the groundwater, the cancer risk will be reduced to 1×10^{-6}. This level falls within the EPA's acceptable risk range of 10^{-4} to 10^{-6}. No short-term threats are associated with the selected remedy that cannot be readily controlled. In addition, no adverse cross-media impacts are expected from the remedy.

Exposure to contaminated surface soils does not pose a current or future risk greater than the

10^{-6} point of departure. However, in light of the current and potential future groundwater uses, soil vapor extraction will be used to effectively to remediate the contaminated soils to levels protective of the Memphis Sands. No short-term threats are associated with the selected remedy cannot be readily controlled. In addition, no adverse cross-media impacts are expected from the remedy.

10.2 Compliance with Applicable or Relevant and Appropriate Requirements

The selected remedy of the North Remediation System (NRS) and plant area soil vapor extraction (SVE); groundwater containment/treatment at Water Plant 2, and supplemental extraction/treatment via air stripping; and institutional controls placed on well construction and water use in the general area of the Site will comply with applicable or relevant and appropriate chemical, action, and location-specific requirements (ARARs). The ARARs are presented below:

Chemical-Specific ARARs:

Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCLs) (42 U.S.C. § 1412 (§ 300g-1); 40 C.F.R. 141.61 and 141.80) have been set for toxic compounds as enforceable standards for public drinking water systems.

SDWA Secondary Maximum Contaminant Levels (SMCLs) (42 U.S.C. § 1412 (§ 300g-1); 40 C.F.R. 143.3) are unenforceable goals regulating the aesthetic quality of drinking water.

SDWA Maximum Contaminant Levels Goals (MCLGs) (42 U.S.C. § 1412 (§ 300g-1); 40 C.F.R. 141.50) are unenforceable health goals.

Clean Water Act (CWA) Federal Water Quality Criteria (33 U.S.C. § 1314(a)(1)(§ 304(a)(1)) are effluent limitations that must meet Best Available Technology (BAT).

Clean Air Act (CAA) National Ambient Air Quality Standards (42 U.S.C. § 7409 (§ 109); 40 C.F.R. Part 50) establishes emissions standards, monitoring and testing requirements, and reporting requirements for eight pollutants in air emissions.

Tennessee Water Quality Control Act (69-3-101) controls and regulates drinking water and discharges to POTW and also to waters of the State.

Location-Specific ARARs

Resource Conservation Recovery Act (RCRA) (42 U.S.C. §§ 6921-39 (§§ 3001-19); 40 C.F.R. Parts 260-70) regulates the treatment, storage, and disposal of hazardous waste from generation through ultimate disposal. Remedial action at the Site may require the handling of materials that constitute RCRA hazardous waste, for example, soil and groundwater residuals or spent carbon (if carbon adsorption is chosen). Any such materials will be handled in compliance with

applicable RCRA requirements.

Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.) requires actions to protect fish and wildlife from actions modifying streams or areas affecting streams.

CAA National Ambient Air Quality Standards (42 U.S.C. § 7409 (§ 109); 40 C.F.R. Part 50) establishes emission standards to protect public health and public welfare. These standards are national limitations on ambient air intended to protect health and welfare.

Action-Specific ARARs

RCRA (42 U.S.C. §§ 6921-39 (§§ 3001-19); 40 C.F.R. Parts 260-70) regulates the treatment, storage, and disposal of hazardous waste from generation through ultimate disposal. Remedial action at the Site may require the handling of materials that constitute RCRA hazardous waste, for example, soil and groundwater residuals or spent carbon (if carbon adsorption is chosen). Any such materials will be handled in compliance with applicable RCRA requirements.

CWA Discharge Limitations (33 U.S.C. § 1311 (§ 301); 40 C.F.R. Parts 122, 125, 129, 133, and 136) prohibits unpermitted discharge of any pollutant or combination of pollutants or combinations of pollutants to waters of the U.S. from any point source. Standards and limitations are established for these discharges to a POTW.

SDWA Undergound Injection Control (UIC) (42 U.S.C. §§ 300h-300h-7 (§§ 1421-8); 40 C.F.R. Parts 144-7) is a permit program designed to prevent contamination of underground sources of drinking water.

CWA Pretreatment Standards (33 U.S.C. § 1317 (§ 307); 40 C.F.R. 403.5) prohibits unpermitted discharge of any pollutant or combination of pollutants or combinations of pollutants to waters of the U.S. from any point source. Standards and limitations are established for these discharges to a POTW.

CWA Dredge and Fill Material Permits - Wetlands (33 U.S.C. § 1344 (§ 404); 40 C.F.R. Part 230) controls the discharge of dredged or fill materials into water of the U.S. such that the physical and biological integrity is maintained.

CAA New Source Performance Standards (42 U.S.C. § 7411 (§ 111); 40 C.F.R. 60) establishes standards of performance for new air emission sources.

CAA National Emission Standards for Hazardous Air Pollutants (42 U.S.C. § 7412 (§ 112); 40 C.F.R. Part 61) establishes emissions standards, monitoring and testing requirements, and reporting requirements for eight pollutants in air emissions.

Occupations Safety and Health Standards Act (29 U.S.C. § 651 et seq.; 29 C.F.R. Part 1910) sets limits on exposure to workers on hazardous site or emergency responses, sets forth

minimum health and safety requirements such as personal protection and training, and reporting requirements.

To Be Considered Materials (TBCs)

EPA Groundwater Protection Strategy (EPA, 1984) is a policy to restore groundwater to its beneficial uses within a time frame that is reasonable. Groundwater beneath and adjacent to the Carrier A.C. Site are Class IIA and IIIA aquifers.

Town of Collierville Municipal Code of Ordinances (10-230) is a promulgated local deed restriction prohibiting installation of wells without a permit.

Shelby County Well Construction Codes (Section 4 and 5) are promulgated local rules and regulations to control and regulate the location, construction, and modification of all types of wells in Shelby County.

Executive Order 11990 Wetlands Protection Policy sets forth policy for the protection of wetlands.

Executive Order 11988 Floodplain Management Policy sets forth policy for the protection of floodplains.

10.3 Cost Effectiveness

The selected remedy, Alternative 4A was chosen because it provides the best balance among criteria used to evaluate the alternatives considered in the Detailed Analysis. This alternative was found to achieve both adequate protection of human health and the environment and to meet the statutory requirements of Section 121 of CERCLA. The present worth cost of Alternative 4A is in the range of $5,717,755 to $7,932,765.

10.4 Utilization of Permanent Solutions and Alternative Treatment Technologies or Resource Recovery Technologies to the Maximum Extent Practicable

EPA and TDEC have determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a cost-effective manner for the final ROD at the Carrier A.C. Site. Of those alternatives that are protective of human health and the environment and comply with ARARs, EPA and TDEC have determined that the selected remedy provides the best balance of trade-offs in terms of long-term effectiveness and permanence, reduction in toxicity, mobility, or volume achieved through treatment, short-term effectiveness, implementability, cost, while also considering the statutory preference for treatment as a principal element and considering State and community acceptance.

The selected remedy treats the principal threats posed by groundwater and soils, achieving significant contaminant reductions. This remedy provides the most effective treatment of any

of the alternatives considered, and will cost less than excavation. The selection of treatment for the contaminated soils and groundwater is consistent with program expectations that highly toxic and mobile wastes are a priority for treatment to ensure the long-term effectiveness of a remedy.

10.5 Preference for Treatment as a Principal Element

By treating the contaminated groundwater and soils by air stripping and soil vapor extractions, the selected remedy addresses the principal threats posed by the Site through the use of treatment technologies. By utilizing treatment as a significant portion of the remedy, the statutory preference for remedies that employ treatment as a principal element is satisfied.

APPENDIX A

RESPONSIVENESS SUMMARY

1.0 RESPONSIVENESS SUMMARY OVERVIEW

The U.S. Environmental Protection Agency (EPA) held a public comment period from April 21 through May 21, 1992, for interested parties to comment on the Remedial Investigation/Feasibility Study (RI/FS) results and the Proposed Plan for the Carrier Air Conditioning Superfund Site (Carrier A.C. Site or the Site) in Collierville, Tennessee.

The Proposed Plan included in Attachment A of this document, provides a summary of the Site's background information leading up to the public comment period. Specifically, the Proposed Plan includes the following sections: Introduction; Background Information; Key Findings of the Remedial Investigation; Scope and Role of Response Action; The Feasibility Study: Developing and Evaluating Remedial (Cleanup) Alternatives-Technologies Considered in Developing Remedial Alternatives; Summary of Alternatives; Evaluation of Alternatives; State Acceptance; Community Acceptance; Summary of Statutory Findings; EPA Criteria for Evaluating Cleanup Alternatives; and Glossary.

EPA held a public meeting at 7:00 pm on April 30, 1992 at the Memphis/Shelby County Public Library, Collierville, Tennesse to outline the RI/FS and describe EPA's proposed remedial alternatives for the Carrier A.C. Site. All comments recieved by EPA during the public comment period will be considered in the final selection of a remedial alternative for the areas of contamination at the Site.

The Responsiveness Summary, required by the Superfund Law, provides a summary of citizen's comments and concerns identified and received during the public comment period, and EPA's responses to those comments and concerns.

This Responsiveness Summary is organized into the following sections and attachments:

1.0 RESPONSIVENESS SUMMARY OVERVIEW: This section outlines the purposes of the public comment period and the Responsiveness Summary. It also references the background information leading up to the public comment period.

2.0 BACKGROUND ON COMMUNITY INVOLVEMENT CONCERNS: This section provides a brief history of the interests and concerns of community regarding the Carrier A.C. Site.

3.0 SUMMARY OF MAJOR QUESTIONS AND COMMENTS RECIEVED DURING THE PUBLIC COMMENT PERIOD AND EPA'S RESPONSES TO THESE COMMENTS: This section summarizes the comments received by EPA during the public comment period, and provides EPA's responses to these comments.

ATTACHMENT A: Attachment A contains written comments received during the public

comment period and EPA's responses to these comments.

ATTACHMENT B: Attachment B contains the Proposed Plan which was distributed to the public during the public meeting held on April 30, 1992 and mailed to the information repository and those included on the mailing list.

ATTACHMENT C: Attachment C includes public notices regarding the Carrier A.C. Site that were published in area newspapers.

ATTACHMENT D: Attachment D includes the official transcript of the Public Hearing on the Proposed Plan for the Cleanup of the Carrier A.C. Site located in Collierville, Tennessee.

2.0 BACKGROUND ON COMMUNITY INVOLVEMENT CONCERNS

2.1 Background on Community Involvement

Governed by a mayor and five alderman, the Town of Collierville has a population of approximately 13,000. It is located in western Tennessee, approximately 20 miles east of Memphis.

The Collierville community takes great pride in its transformation over the past 25 years from a rural to an industrial town. The Town's work force manufactures products as diverse as lumber, automobile parts, and soft drinks. Carrier Air Conditioning is the area's largest employer.

All of the residents and local officials interviewed in 1990 were well aware of the contamination at the Site. They stated that they were quite concerned about the contamination because it had the potential to affect the area's drinking water supply, but that Carrier had done an outstanding job of keeping the community informed as to the nature and extent of the Site problems. Residents trusted Carrier's information and assessment of the problem, and also stated thay they had received a great deal of information from the Collierville municipal government. The residents felt this information has been reliable.

There are no environmental groups in Collierville, and no one interviewed expressed concern regarding EPA's Site investigation plans. Because of potential drinking water problems from the contamination, residents and officials were extremely interested in EPA's plans, and wished to be kept fully informed of all Site work. Officials expressed a strong desire for information, stating that they did not receive as much information as they felt necessary during TDEC's 1986 testing.

2.2 Community Concerns

The following issues and concerns regarding the Site were identified during the public comment

period April 21 to May 21, 1992 and the briefing trip conducted on April 30, 1992.

1. Adjacent landowner's property would be devalued as a result of having shallow groundwater contamination on their property.

2. The safety of the City's drinking water and the community's distrust and anger with their town officials.

3. The safety of Nonconnah Creek.

4. The continued use of TCE at the Carrier manufacturing facility.

5. The toxicity of any remaining substances both in soil and groundwater.

6. TCE continuing to contaminate the Memphis Sands.

7. The air emission standards that apply to the Site.

8. The toxicity of TCE in groundwater after treatment.

III. SUMMARY OF MAJOR QUESTIONS AND COMMENTS RECEIVED DURING THE PUBLIC COMMENT PERIOD AND EPA'S RESPONSES TO THESE COMMENTS

The following is a summary of the major comments, concerns and questions received during the public comment period from April 21 to May 21, 1992 by the local residents together with EPA's responses.

COMMENT: A resident asked if trichloroethylene was still being used at the Carrier Air Conditioning facility.

RESPONSE: EPA stated that TCE has been discontinued in Carrier's manufacturing process.

COMMENT: A resident asked about the toxicity of any remaining substances both in soil and groundwater, and if anything was continuing to go into the Memphis Sands.

RESPONSE: EPA stated that the chemicals in the shallow soil do not stay around the top very long and are very mobile in soil. Rain leaches contamination down into the groundwater which presents an unacceptable risk for the groundwater. Treating the soil will prevent further contamination to the groundwater. The contaminants are removed from groundwater by using the air stripper and as a result the public water supply is safe. The major concern from the Site is a future threat; e.g., if the Water Plant 2 treatment system were to cease operations and a future residential well were installed on-site and starting using this water.

COMMENT: A resident expressed his major concern as being TCE contaminating the Memphis Sand Aquifer.

RESPONSE: EPA stated that the Remedial Action will prevent the migration of TCE to the Memphis Sands.

COMMENT: A resident asked about the difference between Option 4A and Option 4B, and why Option 4A was chosen. Also, he asked what Air Quality Standards will apply to the Site.

RESPONSE: EPA stated that Option 4A was chosen because air stripping was a more proven technology, simpler and easier. In Option 4B, there are problems associated with UV oxidation in that there is bulb burnout, bulb replacement, and additional monitoring. The implementation makes the difference. Option 4A is $5.7 to 7.9 million and Option 4B is $6.1 to 8.4 million.

EPA answered the resident's second question by stating air emissions will be in compliance with the National Ambient Air Quality Standards, recognizing the Site is in a non-attainment area for ozone. The air pollution control equipment will be designed to meet the Air Quality Standards.

COMMENT: A resident asked if the City Well had or will have traces of TCE after treatment. Also, the resident asked who is responsible for testing the well.

RESPONSE: EPA stated that before the treatment the City Well is contaminated with TCE but after the treatment there is no TCE contamination in the treated water. The City Well is being tested by both the City and Carrier's contractor, En Safe, with EPA's oversight.

COMMENT: A resident asked if this City Well was the only one contaminated.

RESPONSE: EPA stated that of the three City Water Plants, Water Plant 2 at Carrier, was the only one contaminated.

COMMENT: A resident expressed concern about liquid or waste observed in Nonconnah Creek and about the changes in the color of soil in the creek bed.

RESPONSE: EPA stated that in the study conducted of Nonconnah Creek, no site-related contaminants were found in the surface water or sediments samples taken in the creek. The problem in the creek was found to be due to erosion because of imposed man-made flow controls. EPA also stated that discoloration in the creek bed soils was most likely due to some type of algae growth.

COMMENT: A resident commented that over the past two years there was a smell of chlorine in her water and during this time her family was plagued with sore throats and stomach problems. Once a filter was put on the drinking water and ice maker, the problems were solved. She asked other families and they were in the same situation.

RESPONSE: EPA stated that this resident and surrounding neighbors receive their drinking water from Water Plant 3 and not from Water Plant 2, which is the one being treated for TCE contamination. So, the chlorine smell was not due to TCE-contaminants but to the aeration and chlorination system of their drinking water supply by the City of Collierville.

ATTACHMENT A

Mr.& Mrs. David Morgan
408 Shelton Rd.
Collierville,Tn. 38017

April 22,1992

Ms. Beth Brown
Remedial Project Manager
U.S. EPA Region IV
345 Courtland Street, N.E.
Atlanta, GA 30365

Dear Ms. Brown,

We are commenting on the attached article concerning Collierville, Tn. Since we do not have the knowledge of what is the best solution to this problem, we have to rely on your expertise in this matter and go along with your recommendation of 4A. All we know is that we were plagued with sore throats and stomach problems until we got a filter for our drinking water and for our ice maker. We have not had to go back to the doctor again for this problem. After this had been resolved in our home, we have talked to a few other people and their problems stopped also after getting filters for their water and ice maker.

For years we have been told nothing is wrong with the water and as a citizen to this community we feel angry and betrayed by our town officials.

Thank you for allowing us the opportunity to express our opinion.

Sincerely,

Mr.& Mrs. David Morgan

Mr.& Mrs. David Morgan

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET, N.E.
ATLANTA, GEORGIA 30365

May 15, 1992

Mr. and Mrs. Morgan
435 Shelton Road
Collierville, Tennessee 38017

Subject: Collierville Public Water Supply

Dear Mrs. Morgan:

This letter is to follow up our phone conversations regarding your interest in the Carrier Air Conditioning Superfund Site as it relates to your public water supply.

As we discussed, the chlorine smell in your drinking water is not due to the Carrier Site and its related TCE contamination. The City of Collierville is responsible for the aeration and chlorination of your drinking water supply. The City maintains daily records of their operations and these should be available to you. Also, the Carrier Site treats the TCE-contaminated groundwater and sends it to Water Plant 2. More than likely, you are serviced by Water Plant 3. If you have questions relating to the drinking water quality, please contact James Mathis with the City of Collierville Public Works Department at (901) 853-2264.

During our phone conversation we also discussed the problem of some residences developing pin-hole leaks in their water pipes. The development of pin-hole leaks in water pipes is not an uncommon problem. It is associated with off-spec pipe rather than the quality of water flowing through the pipes. Off-spec pipe may have an undesirable chemical composition and manufacutring flaws which contribute to a chemical reaction that results in corrosion and pin-hole leaks.

I have forwarded your letter to Ed O'Neil with the Tennessee Department of Environment and Conservation (TDEC) Drinking Water Quality. The TDEC is responsible for overseeing the City's operation and maintenance of the public water supply. Mr. O'Neil may be contacted at (901) 543-6695.

I hope this response satisfies your concerns as they relate to the Carrier Site. If I can be of further assistance, please contact me at (404) 347-7791 or 1-800-435-9233.

Thank you for taking time and expressing interest in this matter.

Sincerely,

Beth Brown

Beth Brown
Remedial Project Manager

cc: Ed O'Neil, TDEC
Jordan English, TDEC

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET, N.E.
ATLANTA, GEORGIA 30365

May 14, 1992

Mr. Ed O'Neil
Tennessee Department of Environment
and Conservation
2500 Mt. Moriah
Perimeter Park, Suite E-645
Memphis, Tennessee 38115-1511

RE: Collierville Drinking Water Supply

Dear Mr. O'Neil:

As we have discussed, I am forwarding a letter from a Collierville resident who responded during the public comment period for the Carrier Air Conditioning Superfund Site.

I spoke with Ms. Morgan regarding her concerns about her drinking water. She explained that over the past two years that she could smell chlorine in their water and also during this time had been plagued with sore throats and stomach problems. When she put a filter on their tap, she no longer smelled chlorine and within a month her family no longer has sore throats or stomach problems. She is aware of several other families that have had similar problems. I explained that at Water Plant 2 where the TCE-contaminated groundwater is treated, that no TCE is detected after treatment. TCE is also not known to cause these type of symptoms. I suggested she contact James Mathis, with the City of Collierville Public Works, if she had any problems related to her drinking water. I also informed her that the City maintains daily records of the drinking water quality that should be available to her.

I have spoken with James Mathis and he has not received any calls regarding concerns about the drinking water. I also was informed that Ms. Morgan's residence is serviced by Water Plant 3 and her home is probably one of the first receptors of the treated water.

Also during the phone conversation with Ms. Morgan, she had concerns about some water pipes in other neighborhoods developing pin-hole leaks. I explained to her that the leaks more than likely developed because of off-spec pipe.

If you have any questions regarding the letter, please contact me at (404) 347-7791.

Sincerely,

Beth Brown

Beth Brown
Remedial Project Manager
Attachment

cc: Jordan English,TDEC

USE THIS SPACE TO WRITE YOUR COMMENTS

Your input on the recommended cleanup plan for the Carrier Air Superfund site is important to EPA. Comments provided by the public are valuable in helping EPA select a cleanup remedy for the Site.

You may use the space below to write your comments, then fold and mail. **Comments must be postmarked by May 21, 1992.** If you have questions about the comment period, please contact Beth Brown at the number listed in the For More Information section on page 10.

Dear Sir:

I H.C. Taylor live and own property about 3/4 mile west of Carrier plant on Nonconnah Ditch. This Ditch in the past was dry, except when it Rain. Now with this waste Dumped in East of me, the ditch is wet and mud at all times. This Ditch we are talking about is a Rain and wet weather Ditch, other than that it is Dry. only thing that is moving liquid or waste is dumped in East at me, no spring or creek fed. This liquid Change the color of the Soil at times from Yellow, Black, Green and Skim on Top. Yes I am concerned, This nonconnah ditch crosses my pasture of cattle area, and my Drinking water well about 600' South of the Ditch. also other homes in this area with the look and odor of this run off I am afraid it not safe for cattle to drink, or could get in Ground water our wells. I had rather be safe than sorrow.

Thanks,
Respectfully Submitted
Henry C. Taylor

Name HENRY C TAYLOR

Address 10842 COLLIERVILLE RD.

City COLLIERVILLE State TENN Zip 38017

Phone (901) 853-8396

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET, N.E.
ATLANTA, GEORGIA 30365

May 15, 1992

Mr. Henry C. Taylor
10842 Collierville Road
Collierville, Tennessee 38017

Subject: Nonconnah Creek, Collierville, TN

Dear Mr. Taylor:

This letter is to follow up our phone conversation regarding your concerns about Nonconnah Creek. Your letter stated that you have observed liquid or waste in the Creek. You have also seen changes in the color of soil in the Creek bed. As we discussed, the problems you have seen are not a result of the Carrier Air Conditioning Superfund Site. EPA conducted a study of Nonconnah Creek in the area of the Carrier facility. No Site-related contaminants were found in surface water or sediment samples taken in the Creek. Our study did indicate that erosion is a problem in the Creek. The Creek is no longer in its natural state because man-made flow controls have been imposed. The use of flow controls cause erosion in some parts of the Creek. The discoloration that you have seen in the Creek bed soils is most likely due to some type of algae growth. I have forwarded your letter to Mr. Jon Leonard with the Tennessee Department of Environment and Conservation. Please contact Mr. Leonard at (901)543-6695 if you have any questions regarding Nonconnah Creek.

If I can be of further assistance, please contact me at (404) 347-7791 or 1-800-435-9233.

Sincerely,

Beth Brown

Beth Brown
Remedial Project Manger

cc: Jordan English, TDEC
Jon Leonard, TDEC

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET, N.E.
ATLANTA, GEORGIA 30365

May 14, 1992

Mr. Jon Leonard
Division of Water Quality
Tennessee Department of Environment
and Conservation
2500 Mt. Moriah, Tennessee 38115-1511

RE: Nonconnah Creek, Collierville, TN

Dear Mr. Leonard:

As we have discussed in previous phone conversations, I am forwarding a letter regarding a Collierville resident's concerns about Nonconnah Creek. The letter was received as part of the public comment period during the remedial process at the Carrier Air Conditioning Superfund Site.

The letter is from Mr. Henry Taylor and his concerns are for the safety of cattle drinking water from Nonconnah Creek and if there is contamination in Nonconnah Creek, could it contaminate his or other residents drinking water wells. I spoke with Mr. Taylor and informed that no Site-related impacts from Carrier were detected in the ecological study. I told Mr. Taylor that I would forward his letter to you and if he had any further questions, to contact you.

If you have any questions, please contact me at (404) 347-7791.

Sincerely,

Beth Brown

Beth Brown
Remedial Project Manager

Attachments

cc: Jordan English, TDEC

ATTACHMENT B

United States
Environmental Protection
Agency

Office of Public Affairs
Region 4
345 Courtland Street, N.E.
Atlanta, GA 30365

Alabama, Florida, Georgia
Kentucky, Mississippi,
North Carolina,
South Carolina

U.S. EPA Issues a Proposed Plan for Remedial Action at the Carrier Air Conditioning Superfund Site

Collierville, Tennessee — April 1992

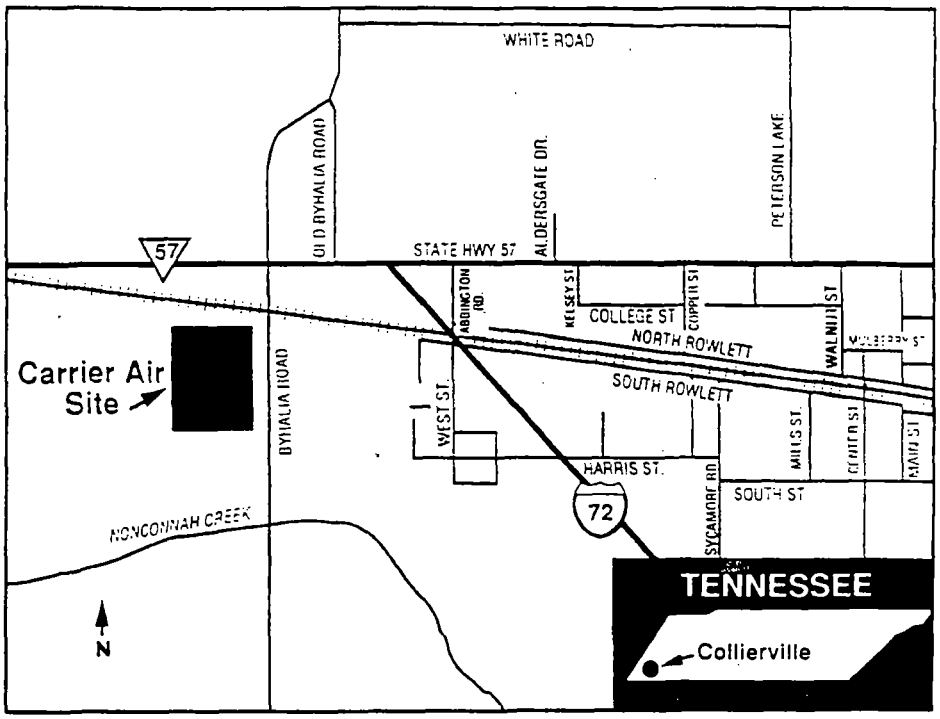
This fact sheet will provide:

- An overall review of the Site.
- The results of the Remedial Investigation.
- The possible health risks posed by the Site.
- A summary of treatment alternatives.
- A summary of the Feasibility Study.
- Information on EPA's preferred alternative.
- Places to get information.
- Upcoming activities in the remediation and Superfund process.

PUBLIC MEETING

DATE: Thursday, April 30, 1992
TIME: 7:00 p.m.
LOCATION:
Memphis/Shelby County
Public Library
91 Walnut Street
Collierville, Tennessee

Printed on recycled paper



INTRODUCTION

This **Proposed Plan** Fact Sheet has been prepared by the U.S. Environmental Protection Agency (EPA) to propose a cleanup plan, referred to as a **preferred alternative**, to address contamination at the Carrier Air Conditioning **Superfund** site (the Site) in Collierville, Tennessee. As the lead agency for oversight of the remedial activities at the Site, EPA has worked in conjunction with the Tennessee Department of Environment and Conservation (TDEC). In its support role, TDEC has reviewed this preferred alternative and concurs with EPA's recommendations. In accordance with Section 117(a) of the **Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)** of 1980, EPA is publishing this Proposed Plan to provide an opportunity for public review and comment on all the cleanup options, known as **remedial alternatives**, under consideration for the Site.

Note: Words that appear in the glossary on pages 10-11 are in **boldface** print the first time they appear in the body of this fact sheet.

This Proposed Plan highlights key information that is contained in the **Remedial Investigation (RI)** and **Feasibility Study (FS)** reports but does not serve as a substitute for these documents. The RI and FS reports are more complete sources of information regarding the remedial activities at the Site and are

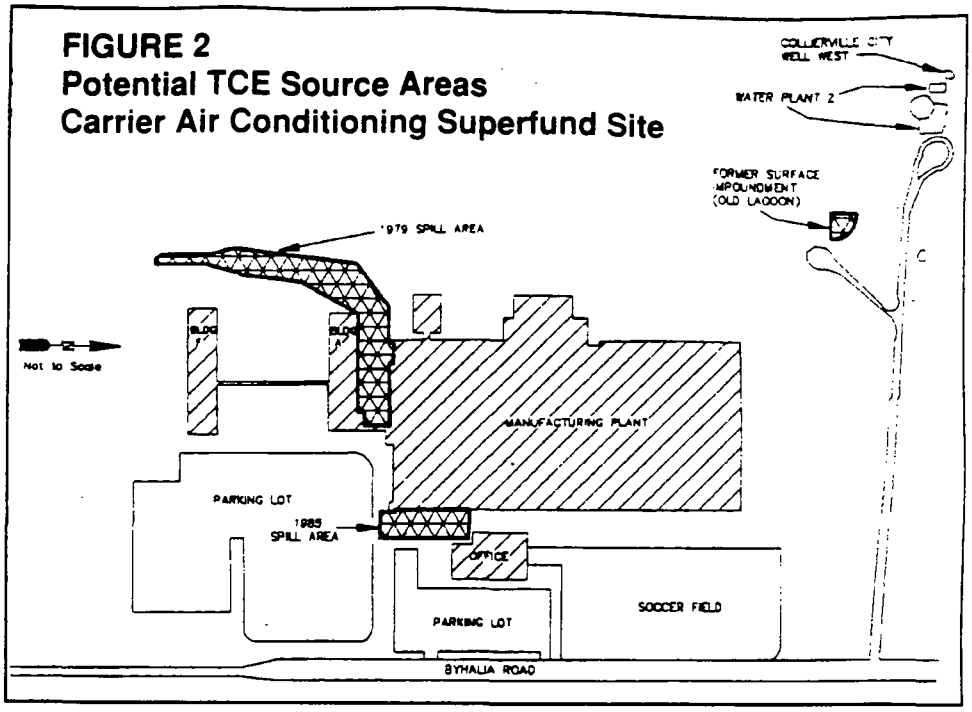
part of the **Administrative Record** for the Site. The Administrative cord consists of technical reports and reference documents used by EPA to compile the Proposed Plan. These documents can be found in the **information repository** located at the Memphis/Shelby County Library, 91 Walnut Street, Collierville, Tennessee.

BACKGROUND INFORMATION

The Carrier site is located on the western side of the Town of Collierville near the intersection of Poplar Avenue and Byhalia Road in Shelby County, Tennessee. The Site consists of approximately 135 acres owned principally by Carrier Corporation (Carrier). In 1967, the town of Collierville purchased the Site property from Robert and Grace Snowden. That same year, Town of Collierville constructed industrial buildings and purchased industrial equipment for the Site. The property, buildings and equipment were leased to Carrier on March 1, 1967. In 1982, the lease was amended to exclude the northwest portion of the property where the Town of Collierville municipal wells are located. On December 14,1987, Carrier purchased all the property included in the lease with the Town of Collierville. Carrier is the current landowner.

Carrier Corporation **operates** a residential heating and **air conditioning** manufacturing **facility** at the Site. In the process of assembling air conditioning units, aluminum sheeting is stamped and assembled with copper tubing to form air heat exchangers. Stamping and forming oils and dirt are removed from these parts prior to final assembly. **Trichloroethylene (TCE)** was, until recently, the primary solvent used to degrease and clean these parts. Two discrete releases (in 1979 and 1985) of TCE occurred

FIGURE 2
Potential TCE Source Areas
Carrier Air Conditioning Superfund Site



from solvent storage systems to an area just south of the main manufacturing building. In addition, a wastewater lagoon, operated from about 1972 to 1979, apparently accepted waste inadvertently contaminated with TCE and **zinc**.

Removal actions were conducted at the former lagoon and both near-plant spill areas. At the lagoon, approximately one foot of sludge was removed. Asphalt pavement and underlying soils were removed from the parking area affected by the 1979 spill of TCE from a degreaser vent pipe. In 1985, about 500 gallons of TCE from a nearby aboveground storage tank pipe were released. A massive soil excavation and disposal action was conducted to remove the affected soils. As a result of the spill, **monitoring wells** were installed at the facility to monitor groundwater.

Since the 1985 spill, the TDEC continued groundwater monitoring at the Site on a regular basis. In July 1986, one of the **extraction wells** in the Town of Collierville's Water Plant 2 was found to be contaminated with low levels of TCE. Water Plant 2, one of two water plants that supplies residents with water, is on the northwest corner of the Site. Water Plant 1 is in downtown Collierville, one and one-half miles east of the Site. Shortly after testing one of the wells in Water Plant 2, the TDEC tested all the wells in both water plants. Although low levels of TCE were found in both wells of Water Plant 2, no TCE was found in any of the wells in Water Plant 1 or in the treated water from either plant. Operation of the wells and the existing plants has continued under frequent monitoring. In 1990, packed aeration towers, also called air strippers, were installed by Carrier at Water Plant 2 to assure removal of trace amounts of TCE and its natural degradation products from the drinking water supply. The plant remains in continuous service providing up to 1.4 million gallons per day of potable water to the Town of Collierville.

In 1987 and 1988, Carrier conducted an extensive Site investigation under an agreement with the TDEC. Sampling indicated measurable amounts of TCE in the soils and smaller amounts of TCE in the **groundwater** at the Site. The Site investigation also confirmed

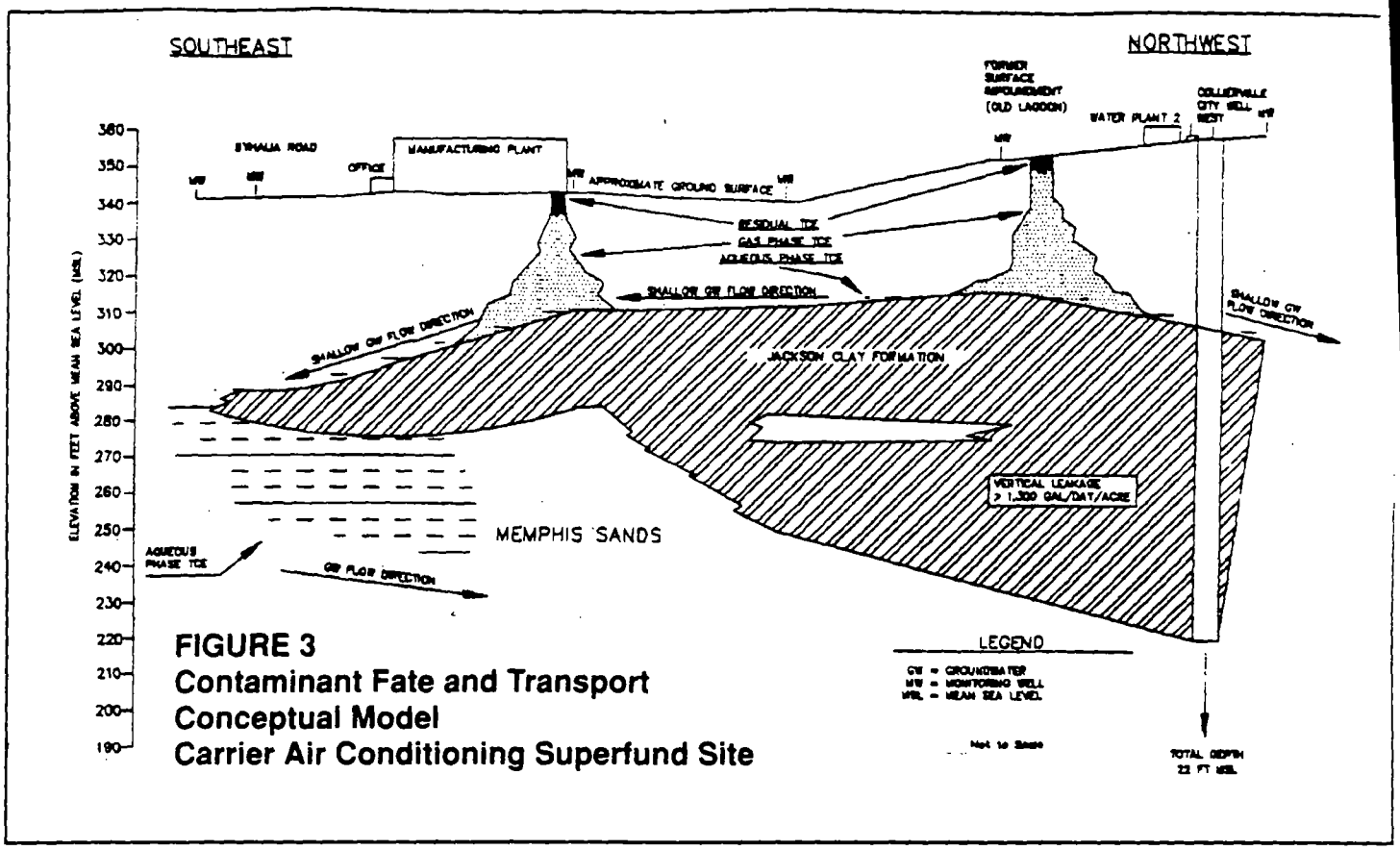


FIGURE 3
Contaminant Fate and Transport
Conceptual Model
Carrier Air Conditioning Superfund Site

the earlier finding of low TCE concentrations in the groundwater from Water Plant 2.

In March 1987, the Site was placed on the TDEC's List of Hazardous Substance Sites. In June 1988, it was proposed for inclusion on EPA's **National Priorities List (NPL)**, and became final in 1990. In September 1989, Carrier and EPA signed an agreement called a CERCLA Consent Order under which Carrier would conduct an RI/FS to determine the type and extent of contamination at the Site and identify alternatives for **Remedial Action**. The RI and FS reports were finalized in April 1992.

KEY FINDINGS OF THE REMEDIAL INVESTIGATION

The findings of the RI confirmed the presence of TCE, TCE-degradation products, **lead** and **zinc** in Site soils and groundwater. The two spill areas and the former lagoon area are the sources of contamination (Figure 2).

Soil samples collected within areas suspected to be affected by spills indicate a wide range of primarily TCE contamination levels. The greatest concentrations were from those areas more directly associated with the 1979 degreaser spill. The vertical extent of TCE contamination in the source areas is variable throughout the Site. The former lagoon area may serve as a source of zinc contamination because of the use of zinc phosphate on the Site and the discharge of zinc phosphate sludges to the lagoon.

Upon completion of the RI, a total of 37 groundwater monitoring wells had been constructed onsite. Elevated levels (above **Maximum Contaminant Levels [MCLs]**) consisting primarily of TCE and **1,2-dichloroethylene (DCE)** were found in most monitoring wells. **Vinyl chloride** was not found at a significant frequency, but it has been included as a contaminant of concern because it, like DCE, is a natural degradation product of TCE and has exceeded MCLs. TCE solvent was not a pure product and contained small amounts of **tetrachloroethene (PCE)** and **1,2-dichloroethane (DCA)**. PCE and DCA have not been detected at significant frequencies, but are included as contaminants of concern because they have exceeded MCLs. Elevated levels (above MCLs) of lead and zinc were found in shallow and deep groundwater samples taken onsite.

The following is a list of the contaminants of concern in soils and groundwater:

Trichloroethylene (TCE)
1,2, Dichloroethane (DCA)
1,2, Dichloroethylene (DCE)
Vinyl Chloride
Tetrachloroethene (PCE)
Lead
Zinc

As part of the RI, a **treatability study** was conducted at the former

lagoon area to determine how effective soil vapor extraction would be for onsite soils and shallow groundwater. Soil vapor extraction is discussed later in the Soil Treatment Technology section. The study indicates that this technology is effective in removing contamination in soils and shallow groundwater.

SCOPE AND ROLE OF RESPONSE ACTION

During the RI, a conceptual understanding of the fate and transport of TCE and its degradation products was developed and refined as sampling phases were completed. In general, Site groundwater is found in two systems.The more shallow (40- to 80-foot depth) groundwater is present intermittently and does not serve as a drinking water source. Movement of groundwater, where it occurs, is generally the south, along the top of a clay confining layer. This layer thins to non-existence at the southern extent of the Site (Figure 3).

A deeper sand aquifer, the Memphis Sands, is recharged regionally from areas to the south and east of the Site. The shallow and the Memphis Sands groundwater combine at the southern extent of the Site. The Memphis Sands is generally a high quality, confined aquifer, with a regional thickness of about 500 feet, and flow direction to the north and west. This aquifer is used as the drinking water source for the Town of Collierville.

Data collected to date indicate that TCE and degradation products migrate from the residuals in soils to the aqueous phase in shallow groundwater. The groundwater slowly moves along the top of the Jackson Clay, primarily toward the southern and western extent of the Site. This contamination moves down to the Memphis Sands in areas where the Jackson Clay unit is absent.

Long-term, the objective remains to prevent exposure by removing the route of exposure (through institutional controls), or the contaminant itself (through treatment), or a combination of the two. Remedial action objectives for groundwater are:

1) Prevent ingestion of groundwater contaminated at or above mandated **Maximum Contaminant Levels (MCLs).**

2) Prevent further contamination of the Memphis Sands.

3) Restore the Memphis Sands aquifer to contamination levels below MCLs.

4) Prevent migration of contaminants from soils that cause the Memphis Sands aquifer groundwater to exceed MCLs.

The remedial alternatives under consideration are summarized in this fact sheet. The FS Report presents a more thorough description and evaluation of these alternatives.

Based on new information or public comments, EPA, in consultation with the TDEC, may modify the preferred alternative or select another response action presented in this Proposed Plan and the FS Report. The public is encouraged to review and comment on all alternatives identified.

SUMMARY OF SITE RISKS

During the RI, an analysis was conducted to estimate the human health or environmental problems that could result if the contamination identified at the Site was not cleaned up. This analysis, known as a **Baseline Risk Assessment,** focused on the potential health effects from long-term direct exposure to the contaminants found at the Site.

EPA has concluded the major risks to human health and the environment at the Site would be ingestion of groundwater in the Memphis Sands aquifer contaminated with TCE and lead. At the present time, because of the continued operation of the existing Town of Collierville Water Plant 2 treatment system, no actual unacceptable exposure is occurring. However, should the Town of Collierville Water Plant 2 treatment system cease operation, or should a future residential well be installed onsite, the existing concentrations of TCE and lead in the Memphis Sands aquifer would exceed EPA's target risk levels.

Several additional pathways were evaluated or considered, but the current or future impacts were found to be within the acceptable risk levels. For example, the shallow groundwater aquifer was not considered a viable pathway due to its low yield. Ingestion and dermal contact with Site soils was considered and these risks did not exceed target risk levels. However, cleanup of Site soils is necessary to address the source of TCE contamination migrating to the Memphis Sands aquifer. Surface water and sediment samples of the Nonconnah Creek were evaluated for possible contaminant impact on the Creek and its inhabitants. The data indicates no adverse impacts from the Site have occurred or are likely to occur in Nonconnah Creek. In addition, the air pathway was not considered to be a viable pathway because a large portion of the contaminated area is paved/covered. The unpaved areas of the Site have insignificant contamination in surface soils and would not contribute to air emissions.

THE FEASIBILITY STUDY: DEVELOPING AND EVALUATING REMEDIAL (CLEANUP) ALTERNATIVES

Technologies Considered in Developing Remedial Alternatives

1) GROUNDWATER TREATMENT

Ultraviolet Light-Enhanced Oxidation

This technology converts organic contaminants in water to a less toxic form using a chemical reaction to increase the oxygen content in the contaminants, thereby reducing the level of many organic contaminants in water. This method is an innovative treatment technology and would require pilot testing to be conducted at the Site.

Air Stripping

Air stripping is a proven technology for removing **Volatile Organic Compounds (VOCs)**. In this process, contaminated water enters either a packed tower or spray chamber and flows downward while air flows upward from the bottom chamber, stripping VOCs from the water. The treated water is collected at the bottom of the tower and is pumped through subsequent processes or is discharged. Air containing VOCs moves to the top of the tower and either exits the tower to the atmosphere or is treated further.

2) SOIL TREATMENT

Soil Vapor Extraction (SVE)

SVE is a proven technology for *in-situ* removal of VOCs from soil. This process consists of applying a vacuum stress to soils (by standard wells or horizontally arranged perforated pipes). By increasing pressure in the soil pore spaces, contaminants are extracted in vapor phase. The air containing VOCs either exits to the atmosphere or is treated further.

Low Temperature Thermal Desorption (LTTD)

Thermal desorption includes a number of different processes that use either direct or indirect heat exchange to increase the temperature of a waste material and volatilize organic contaminants. The volatilized contaminants are treated by an off-gas system. The solids may be destroyed in an afterburner or collected by a physical/chemical treatment system.

3) AIR TREATMENT

Carbon Adsorption

Carbon adsorption is a proven, reliable treatment process for removing a variety of organic compounds. Carbon adsorption involves passing vapors through a chamber that is packed with granular carbon particles. Organic contaminants attach to the carbon, effectively removing contaminants from the vapors.

Low Temperature Thermal Desorption (LTTD)

LTTD involves combustion of VOCs in a fume incinerator. This method is highly effective in the complete destruction of VOCs.

Ultraviolet Photolysis

This technology is similar to groundwater ultraviolet oxidation.

4) DISPOSAL ACTIONS

Groundwater Discharge

Extracted groundwater after treatment will be discharged to: (1) the Town of Collierville water supply, (2) the surface water onsite, (3) the publicly owned treatment works (POTW), or (4) the Memphis Sands by reinjection. All groundwater discharge will be in compliance with ARARs.

Hazardous Waste Disposal

As the contaminated groundwater is treated, used carbon will be removed and collected for proper disposal. Three possible disposal options are landfilling of the waste at an offsite, federally approved hazardous waste facility; incineration of the materials at an offsite federally approved facility; or used carbon regeneration. Under regeneration, the carbon is placed in a high temperature oven that "bakes" off the contaminants. The carbon may then be reused.

Disposal of soils removed from contaminant source areas will remain onsite or will be shipped offsite for disposal. These disposal actions are subject to federal land disposal restrictions and treatment standards.

Summary of Alternatives

T public is encouraged to comment on the preferred alternative as well as the other source and groundwater cleanup alternatives that EPA evaluated. This section summarizes these alternatives, which are presented in greater detail in the FS report.

To avoid redundancy in the summary of each alternative, several specific components common to all remedial alternatives, except for Alternative 1, are listed below:

- The placement of land and water deed restrictions on the Site and in the area.
- Periodic monitoring to assess the effectiveness of the remedy for at least the next 30 years.
- Continued operation of the Town of Collierville's Water Plant 2, which treats the groundwater by air stripping. The need for off-gas treatment with carbon adsorption, thermal, or ultraviolet photolysis will be decided during **Remedial Design**.
- Continued operation of the soil-vapor extraction (SVE) at the former lagoon, also referred to as the North Remediation System (NRS).
- Extracted groundwater after treatment will be discharged to (1) the Town of Collierville water supply, (2) the surface water onsite, (3) the publicly owned treatment works (POTW), or (4) the Memphis Sands by reinjection.
- Administrative standards, such as air emission limitations, water quality requirements for discharge, and approvals to transport hazardous waste offsite will be met. The need for administrative standards will be determined during Remedial Design (RD).

ALTERNATIVE 1
No Action

CERCLA requires that the "No Action" alternative be considered to serve as a basis against which other alternatives can be compared. Under the No Action alternative, the Site would be left "as is." Periodic monitoring of raw and treated groundwater at the water plant and monitoring wells would be conducted for at least the next 30 years.

The No Action alternative would fail to protect the Memphis Sands aquifer from further contamination and without Water Plant 2's treatment facility in operation, groundwater would exceed MCLs.

ALTERNATIVE 2
North Remediation System (NRS)

Groundwater Containment/ Treatment (at Water Plant 2)

This remedial action provides for SVE at the lagoon area, also referred to as the North Remediation System (NRS), and continued operation of the Town of Collierville's extraction wells, and air stripping at Water Plant 2.

The town wells at Water Plant 2 will continue to operate to provide containment and treatment of the contaminated Memphis Sands groundwater. Some uncertainty exists with respect to the degree of containment provided by operation of Water Plant 2.

Alternative 2 will not be further evaluated because it addresses only soils near the former lagoon area. With no response action directed toward source soils near the manufacturing plant, these will continue to be a significant source of contamination over a period on the order of 2000 years. Without more rapid source control, restoration of the Memphis Sands cannot be accomplished in a timely manner.

ALTERNATIVE 3
North Remediation System (NRS)

SVE (in the Main Plant Area)

Groundwater Containment/ Treatment (at Water Plant 2)

In addition to operation of the NRS, which is soil vapor extraction at the old lagoon area onsite, and groundwater containment/treatment as described in Alternative 2, this alternative addresses the remediation of contaminated soil in the main plant area by SVE.

ALTERNATIVE 4
North Remediation System (NRS)

SVE (in the Main Plant Area)

Groundwater Containment/ Treatment (at Water Plant 2 and with Supplemental Extraction Wells)

Alternative 4 differs from Alternative 3 in that supplemental wells will be installed to provide for containment of contaminated groundwater that is not captured by Water Plant 2. The supplemental extraction wells will also protect the Memphis Sands from further contamination.

Two treatment options for the contaminated groundwater from the supplemental wells were considered under this alternative:

Option 4A: Air Stripping

Option 4B: Ultraviolet (UV)/ Oxidation

ALTERNATIVE 5
Plant Area Soil Excavation

Low Temperature Thermal Desorption (LTTD)

North Remediation System (NRS)

SVE (at Main Plant Area)

Groundwater Containment/ Treatment (at Water Plant 2)

Alternative 5 differs from Alternative 3 in that it introduces excavation and on-site thermal treatment at the main plant area.

The highly contaminated source areas (> 533 ug/kg) will be excavated, where practicable, to an approximate depth of 15 feet and backfilled with clean native soil. Then

SVE will be used to remediate the deeper contamination where excavation is not possible. The contaminated soil will then be treated with LTTD and remain onsite or be shipped offsite for disposal.

ALTERNATIVE 6

Plant Area Soil Excavation

Low Temperature Thermal Desorption (LTTD)

North Remediation System (NRS)

SVE (at Main Plant Area)

Groundwater Containment/ Treatment (at Water Plant 2 and with Supplemental Wells)

Alternative 6 combines Alternatives 4 and 5. This alternative provides for excavation and onsite thermal treatment at the main plant area, followed by SVE for deeper contamination. Groundwater will be contained by the well field at Water Plant 2 and with supplemental extraction wells. The groundwater treatment options at the supplemental wells are the same as in Alternatives 4A and 4B.

Evaluation of Alternatives

The preferred alternative for the Carrier site is Alternative 4A. Based on current information, this alternative provides the best balance among the nine criteria that EPA uses to evaluate alternatives. These criteria are described on page 9. The Evaluation of Remedial Alternatives table on page 8 provides an analysis and comparison of the alternatives under consideration for the Carrier site based on EPA's evaluation criteria.

The following is additional information regarding two of these criteria, state and community acceptance, that is not fully explained in the evaluation table on page 8.

State Acceptance

The TDEC has assisted EPA in the review of reports and Site evaluations. The State has reviewed and tentatively agrees with the proposed remedy and is awaiting public comment before final concurrence.

Community Acceptance

Community acceptance of the various alternatives will be evaluated during the public comment period and will be described in the **Record of Decision (ROD)** for the Site.

EPA's Proposed Plan for Remedial Action

The preferred alternative, Alternative 4A, utilizes established contaminant removal and treatment techniques for soil and groundwater remediation. Contaminated soil in the old lagoon and main plant areas will be remediated using SVE.

Contaminated groundwater will be removed from the aquifer using the existing extraction wells (at Water Plant 2) and supplemental extraction wells. The combination of these wells will ensure contamination does not migrate offsite and will minimize further contamination of the Memphis Sands aquifer. The contaminated groundwater from the existing town well field will be pumped to Water Plant 2 and treated using air stripping. In addition, the contaminated groundwater from the supplemental extraction wells will be pumped to an air stripper.

The treated water from the extraction wells will be (1) discharged to the municipal water supply; (2) discharged to a local POTW; (3) discharged to surface water; or (4) reinjected to the Memphis Sands aquifer.

Air quality standards will be met using off-gas carbon adsorption, a fume incinerator, or ultraviolet photolysis should monitoring indicate air controls are necessary.

This alternative also includes land and water deed restrictions on the Site and in the area; periodic monitoring to assess the effectiveness of the remedy; and administrative requirements for air emission limitations, water quality discharge or reinjection requirements; and approval for off-site disposal of hazardous waste. The need for administrative standards will be determined during Remedial Design (RD).

Alternative 4A will permanently reduce the risk of exposure to contaminants in soil and groundwater and will also prevent further contamination to the environment.

Summary of Statutory Findings

In summary, the preferred alternative represents the best balance among the criteria used to evaluate remedies. Based on the information currently available, EPA has determined that the preferred alternative would be protective of human health and the environment; would use permanent technologies to the extent practicable; would permanently and significantly reduce volume, toxicity, and mobility; would attain ARARs; and would be cost effective.

EVALUATION OF REMEDIAL ALTERNATIVES								
Evaluation Criteria	1	2	3	4A	4B	5	6A	6B
Overall Protection of Public Health and the Environment	No protection provided.	Limited protection provided.	Will provide overall protection of public health. May not protect the Memphis Sands from further contamination and may not fully protect the environment from off-site groundwater contamination.	Will provide overall protection of human health. Minimizes further contamination of Memphis Sands and will prevent offsite groundwater contamination.	Same as Alternative 4A.	Same as Alternative 3.	Same as Alternative 4A.	Same as Alternative 4A.
Compliance with ARARs (State and Federal Regulations)	Does not comply with ARARs.	Complies with ARARs.	Complies with ARARs.	Complies with ARARs.	Complies with ARARs.	Complies with ARARs.	Complies with ARARs.	Complies with ARARs.
Long-Term Effectiveness and Permanence	Groundwater above MCLs and left uncontained.	Most groundwater above MCLs contained and treated at Water Plant 2. Adequacy of groundwater containment uncertain. Source left untreated	Most groundwater above MCLs contained and treated at Water Plant 2. Adequacy of groundwater containment uncertain.	All groundwater above MCLs contained and treated at Water Plant 2 and supplemental wells. Adequate groundwater containment.	Same as 4A.	Same as 3.	Same as 4A.	Same as 4A.
Reduction of Toxicity, Mobility, or Volume (TMV)	No reduction in TMV.	Soils treated to levels protective of groundwater. Most groundwater treated. Significant residuals.	Soils treated to levels protective of groundwater. Most groundwater treated. Minimal residuals.	Soils treated to levels protective of groundwater. All groundwater treated. Minimal residuals.	Same as 4A.	Same as 3.	Same as 4A.	Same as 4A.
Short-Term Effectiveness	Minimal risk to community and workers. No short-term protection of public health or the environment.	Minimal risk to community and workers. Short-term public health protection provided, but may not contain all groundwater contamination.	Minimal risk to community and workers. Short-term public health protection provided, but may not contain all groundwater contamination.	Minimal risk to community and workers. Short-term public health provided.	Same as 4A.	Physical risks associated with excavation and treatment of contaminated soils. Minimal risks to community and workers. Short-term public health is provided.	Same as 5.	Same as 5.
Time Required to Remediate	~ 2000 years	~ 2000 years	~ 3-5 years soil < 30 years GW	~ 3-5 years soil < 30 years GW	~ 3-5 years soil < 30 years GW	~ 2-3 years soil < 30 years GW	~ 2-3 years soil < 30 years GW	~ 2-3 years soil < 30 years GW
Implementability	Routine monitoring procedures.	Technology readily available.	Technology readily available. Pilot study for SVE at plant area. Somewhat difficult to verify compliance with soil cleanup criteria.	Technology readily available. Pilot study for SVE at plant area. Moderately difficult to verify compliance with soil cleanup criteria.	UV/Oxidation available, but new technology that requires regular bulb replacement. Pilot studies required for plant area SVE and UV/Oxidation. Moderately difficult to verify compliance with soil cleanup criteria.	Same as 4A.	Same as 4A.	Same as 4B.
Present Net Worth Cost (In Millions)	$1.4 - 2.2	$3 - 4 million	$5.7 - 7.5	$5.7 - 7.9	$6.1 - 8.4	$9.5 - 14	$9.8 - $14.5	$10 - 14.9

COMMENT FORM

The public comment period for the Carrier Air Superfund site is from **Tuesday, April 21**, to **Thursday, May 21, 1992.**

At the end of the comment period, EPA will review and consider all comments before making a final cleanup decision for the Carrier Air Superfund site. The final cleanup plan for this Site unit, therefore, may be different from the proposed plan.

Fold on dashed lines, staple, stamp, and mail

Name _____

Address _____

City/State/Zip _____

Place Stamp Here

Beth Brown
Remedial Project Manager
U.S. EPA Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

EPA CRITERIA FOR EVALUATING CLEANUP ALTERNATIVES

Overall protection of public health and environment: Degree to which each alternative eliminates, reduces, or controls threats to public health and environment through treatment, engineering methods, or institutional controls (e.g., deed, land use or other restrictions).

Compliance with State and Federal Requirements: Degree to which each alternative meets environmental regulations determined to be applicable or relevant and appropriate to site conditions.

Short-Term Effectiveness: Length of time needed to implement each alternative and the risks posed to workers and nearby residents during implementation.

Long-Term Effectiveness: Ability to maintain reliable protection after implementation.

Reduction of Mobility, Toxicity, and Volume: Degree to which alternative reduces (1) ability of contaminants to move through the environment, (2) harmful nature of contaminants, and (3) amount of contamination.

Implementability: Technical feasibility (difficulty of constructing, operating or maintaining) and administrative ease (e.g., amount of coordination with other government agencies or relocation of residents) of implementing remedy, including availability of goods or services.

Cost: Benefits of alternative weighed against cost.

State Acceptance: EPA requests State comments on the Proposed Plan and concurrence on final remedy selection.

Community Acceptance: EPA holds a public comment period to get input from the affected community and considers and responds to all comments received prior to the final selection of a remedial (long-term cleanup) action.

THE NEXT STEP: THE COMMUNITY'S ROLE IN THE SELECTION PROCESS

EPA solicits input from the community on the cleanup methods proposed for each Superfund response action. **EPA has set a public comment period from April 21 through May 21, 1992, to encourage public comment participation in the selection process.** The comment period includes a public meeting at which EPA will present the RI/FS Report and Proposed Plan, answer questions, and receive both oral and written comments. **The public meeting is scheduled for 7:00 PM, April 30, 1992, and will be held at the Memphis/Shelby County Public Library in Collierville.** Comments will be summarized and responses provided in the Responsiveness Summary section of the ROD, which is the document that presents EPA's final selection for Site cleanup. The public can send written comments to or obtain further information from:

Beth Brown
Remedial Project Manager
U.S. EPA Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365
(404) 347-7791

The Proposed Plan and the RI and FS Reports have been placed in the information repository and Administrative Record for the Site. The Administrative Record includes all documents, such as work plans, data analysis, public comments, transcripts, and other relevant Site material that was used in developing the remedial alternatives for the Carrier site. These documents are available for public review and copying at the following location:

Memphis/Shelby County Public Library
91 Walnut Street
Collierville, Tennessee

TECHNICAL ASSISTANCE GRANTS

EPA is providing communities with the opportunity to apply for Technical Assistance Grants (TAGs). These grants, of up to $50,000 (per site), are designed to enable residents or a community group to hire a technical advisor or consultant to assist them in interpreting and commenting on site findings and the remedial action. There is a limit of one TAG per site. Citizens who are interested in the TAG program may obtain an application package by calling or writing the EPA Community Relations Coordinator listed in this fact sheet on page 10 (see For More Information column).

FOR MORE INFORMATION

The following EPA and TDEC representatives may be contacted for additional information about the Carrier Air Superfund site.

EPA Contacts

Beth Brown
Remedial Project Manager
U.S. EPA Region IV
345 Courtland Street, N.E.
Atlanta, GA 30365
(404) 347-7791

Suzanne Durham
Community Relations Coordinator
U.S. EPA Region IV
345 Courtland Street, N.E.
Atlanta, GA 30365
(404) 347-7791

Peter Raack
Assistant Regional Counsel
U.S. EPA Region IV
345 Courtland Street
Atlanta, Georgia 30365
(404) 347-2641

Glenn Adams
Groundwater Risk Assessment
U.S. EPA Region IV
345 Courtland Street
Atlanta, Georgia 30365
(404) 347-3866

TDEC Contacts

Jordan English
Tennessee Department of Environment and Conservation
Superfund Division
2500 Mt. Moriah
Perimeter Park, Suite E-645
Memphis, Tennessee 38115-1511

Suzanne Wilkes
Community Relations Coordinator
Tennessee Department of Environment and Conservation
Superfund Division
Doctors Building
706 Church Street
Nashville, Tennessee 37219
(615) 741-6287

GLOSSARY

Administrative Record: A file that is maintained and contains all information used by the lead agency to make its decision on the selection of a response action under CERCLA. This file is required to be available for public review and a copy is to be established at or near the site, usually at an information repository. A duplicate file is maintained in a central location, such as a regional EPA or State office.

Applicable or Relevant and Appropriate Requirements (ARARs): This term refers to the Federal and State requirements that a remedy the EPA selects must attain. These requirements may vary from site to site.

Aquifer: A geologic formation that contains sufficient permeability to yield significant quantities of groundwater to wells and springs.

Baseline Risk Assessment: An assessment that provides an evaluation of the potential threat to human health and the environment in the absence of no further actions being taken at the site.

Carcinogen: Any substance that causes cancer.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): A federal law passed in 1980 and amended in 1986 by the Superfund Amendments and Reauthorization Act. This law created a special tax that goes into a trust fund, commonly known as Superfund, to investigate and clean up abandoned or uncontrolled hazardous waste sites. Under the Superfund program, EPA can either pay for site cleanup when the responsible parties cannot be located or are unwilling or unable to perform the work, or take legal action to force responsible parties to clean up the site or reimburse EPA for the cost of the cleanup.

1,2-Dichloroethane (DCA): A volatile organic compound commonly used as a solvent. DCA is toxic by ingestion, inhalation, and skin contact.

1,2-Dichloroethene (DCE): A volatile organic compound that is known to be toxic when absorbed by skin. DCE is used as a solvent and is also a natural degradation product from TCE.

Extraction Wells: Similar to drinking water wells, but constructed so that large volumes of water can be drawn from below the ground surface.

Feasibility Study (FS): A Feasibility Study (FS) evaluates different remedial alternatives for site cleanup and recommends the alternative that provides the best balance of protectiveness, effectiveness, implementability, and cost.

Groundwater: Water that fills the spaces among soil, sand, rock, and gravel particles beneath the earth's surface. Precipitation, such as rain, reaches the ground and then slowly moves through soil, sand, gravel, and rock into small cracks and crevices below the ground surface. During a process that can take many years, groundwater has the potential of becoming a water source. This water may then be withdrawn from wells for use as drinking water.

GLOSSARY

Hazardous Substances: Any material that poses a threat to public health or the environment. Typical hazardous substances are materials that are toxic, corrosive, ignitible, explosive, or chemically active, as defined in CERCLA.

Information Repository: A file containing current information, technical reports and reference documents regrading a Superfund site. The information repository is usually in a public building, such as a public school, city hall, or a library, that is conveniently located for community residents. As the site proceeds through the Superfund remedial process, the file at the information repository is continually updated.

Lead: A naturally occurring element that may be used in manufacturing processes and facility structures. Toxic by ingestion and inhalation of dust or fumes.

Maximum Contaminant Level (MCL): The maximum permissible level of a contaminant in water delivered to any user of a public water system. MCLs are enforceable standards under the Safe Drinking Water Act.

Monitoring: The continued collection of information about the environment that helps gauge the effectiveness of a cleanup action.

Monitoring Wells: Special wells drilled onsite where groundwater can be sampled at selected depths and studied to determine such things as the direction of groundwater flow and the types and amounts of contaminants present.

National Priorities List (NPL): List of sites contaminated with hazardous substances in the United States which are ranked by actual or potential risk to public health and the environment. Placement on this list means that a site qualifies for cleanup assistance under the terms of CERCLA.

Organic Compound: One of the two large classes of chemical compounds, organic and inorganic. It is a term used to describe a chemical containing the element carbon. Examples of organic materials include petroleum products, solvents, oils and pesticides.

Parts Per Billion (ppb): A unit of measurement used to describe levels of contamination. For example, one gallon of a liquid in one billion gallons of water is equal to one part per billion.

Preferred Alternative: EPA's selected best alternative, based on information collected to date, to addresss contamination at a site.

Proposed Plan: A fact sheet summarizing EPA's preferred cleanup strategy for a Superfund site, the rationale for the preference, and a review of the alternatives developed in the RI/FS process.

Record of Decision (ROD): A public document that explains which cleanup alternative will be used at a Superfund site and the reasons for choosing that cleanup alternative over other possibilities.

Remedial Action (RA): The actual construction or implementation phase that follows the remedial design of the selected cleanup alternative at a Superfund site.

Remedial Alternatives: A list of the most technologically feasible alternatives for a cleanup strategy.

Remedial Design (RD): An engineering phase that follows the record of decision when technical drawings and specifications are developed for the subsequent remedial action at a Superfund site.

Remedial Investigation (RI): A Remedial Investigation (RI) examines the nature and extent of contamination problems at a site.

Solvents: Liquids capable of dissolving other liquids or solids to form a solution. The chief uses of industrial solvents are as cleaners and degreasers. Many solvents are flammable and toxic to varying degrees.

Superfund: A term commonly used to describe the Federal program established by CERCLA.

Superfund Amendments and Reauthorization Act (SARA): Amendments to CERCLA enacted on October 17, 1986.

Target Risk: Value system that describes the level of risk associated with a particular contaminant.

Tetrachloroethylene (PCE): A chemical used in dry cleaning, metal degreasing, textile dyeing, and various pesticides. PCE can cause liver and kidney damage.

Treatability Study: A study to evaluate the effectiveness of a technology in remediating contamination.

Trichloroethylene (TCE): A volatile organic compound commonly used as a solvent and degreaser. TCE can be absorbed by humans through inhalation and ingestion, and is associated with kidney and liver damage.

Vinyl Chloride: A volatile organic compound that may be produced from naturally degrading TCE. Studies have shown that vinyl chloride causes cancer.

Volatile Organic Compounds (VOCs): Organic compounds that are characterized by being highly mobile in groundwater and that readily volatilize into the atmosphere.

Zinc: A naturally occurring element used to form a wide variety of alloys including brass, bronze, iron, and various solders. Zinc is not considered a carcinogen.

MAILING LIST
ADDITIONS / CORRECTIONS

If you did not receive this fact sheet in the mail, you are not on the EPA's mailing list for the Carrier Air Conditioning Superfund site. If you would like your name added to the list, please fill out this form, detach and mail to:

Beth Brown
Remedial Project Manager
U.S. EPA Region IV
345 Courtland Street, N.E.
Atlanta, Georgia 30365

Name _____

Address _____

Telephone _____

Affiliation _____

U. S. Environmental Protection Agency
Region 4
Office of Public Affairs
345 Courtland Street, N.E.
Atlanta, Georgia 30365

Inside: Carrier Air Conditioning Superfund Site Proposed Plan

ATTACHMENT C

COLLIERVILLE HERALD APRIL 23, 1982

EPA to Recommend Remedies at Carrier

A proposed plan for remedial action at the Carrier Air Conditioning Superfund site in Collierville will be discussed by the United States Environmental Protection Agency in a public meeting at the Collierville Library, 91 Walnut St., Thursday, April 30, at 7 p.m.

James Mathis, director of Collierville's Utilities Department, says the recommendation of EPA is essentially the same remedy currently in use. "The system now in use is adequately dealing with any contaminants. We don't anticipate any more surprises from this site related to previous contaminant spills. But we will continue to monitor and treat the site, if necessary," Mathis said.

Two spills of trichloroethylene on the site, one in 1979 and another in 1985, have caused contamination in two wells at Water Plant 2 which adjoins Carrier Corp. plant on Byhalia Rd. But through an air stripping process and the use of supplemental extraction wells, the town has been able to remove all traces of TCE in the town's potable water, according to Mathis and EPA.

The recommendation of the agency says the methods being [illegible] and groundwater and will also prevent further contamination to the environment." The recommendation is also the one which will most nearly protect Memphis Sands aquifer, where Collierville gets its water.

Protective measures already in place for the site are:

- Placement of land and water deed restrictions on the site and in the area.
- Periodic monitoring to assess the effectiveness of the remedy for at least the next 30 years.
- Continued operation of the soil-vapor extraction at the former lagoon on Carrier property.
- Extracted groundwater after treatment will be discharged to the Town of Collierville water supply, the surface water on site, the publicly owned treatment works or the Memphis Sands by reinjection.
- Administrative standards, such as air emission limitations, water quality requirements for discharge, a[illegible] to transport hazardous waste offsite will be met.

EPA

THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
is accepting
PUBLIC COMMENTS
on the
CARRIER AIR CONDITIONING SUPERFUND SITE
FEASIBILITY STUDY/PROPOSED PLAN

The U.S. Environmental Protection Agency (EPA) recently completed a Feasibility Study and Proposed Plan that evaluated cleanup alternatives for addressing contamination at the Carrier Air Conditioning Superfund site in Collierville, Tennessee. These alternatives are:

1. No Action.
2. *North Remediation System (NRS); Groundwater Containment at Water Plant 2.
3. NRS and Soil Vapor Extraction at Plant Area; Groundwater Containment at Water Plant 2.
4A. NRS and Soil Vapor Extraction at Plant Area; Groundwater Containment at Water Plant 2 and Supplemental Extraction Wells with Air Stripping.
4B. NRS and Soil Vapor Extraction at Plant Area; Groundwater Containment at Water Plant 2 and Supplemental Extraction Wells with Ultraviolet Oxidation.
5. Excavation/Low Temperature Thermal Desorption; NRS; Soil Vapor Extraction at Plant Area; Groundwater Containment at Water Plant 2.
6A. Excavation/Low Temperature Thermal Desorption; NRS; Soil Vapor Extraction at Plant Area; Groundwater Containment at Water Plant 2 and Supplemental Extraction Wells with Air Stripping.
6B. Excavation/Low Temperature Thermal Desorption; NRS; Soil Vapor Extraction at Plant Area; Groundwater Containment at Water Plant 2 and Supplemental Extraction Wells with Ultraviolet Oxidation.

*North Remediation System (NRS) is soil evaporation aeration in the old lagoon area.

EPA is recommending an alternative for remediation of the site to date. The preferred alternative is number 4A. This alternative is the most effective for addressing contamination at the Carrier site. It will minimize the potential for future exposure and provide protection for public health and the environment.

Copies of the Feasibility Study, Proposed Plan and other site related documents will be available for review at:

Memphis/Shelby County Public Library
91 Walnut Street
Collierville, Tennessee

An administrative record, which contains the information used in the selection of the cleanup plan will also be available for review at the Memphis/Shelby Public Library.

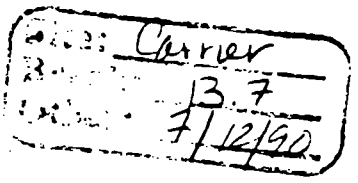
Comments on the Feasibility Study and Proposed Plan may be submitted from April 21 to May 21, 1992, to:

Barb Brown
Remedial Project Manager
U.S. EPA Region IV
345 Courtland Street, N.E.
Atlanta, GA 30365
(404) 347-7791

Comments will also be accepted at a

PUBLIC MEETING
Thursday, April 30, 1992
7:00 p.m.
Memphis/Shelby County Public Library
91 Walnut Street
Collierville, Tennessee

INDEPENDENT
THURSDAY, JULY 12, 1990



Tests show No TCE In Water

by BARRY HEIFNER
Managing Editor

COLLIERVILLE — Director of Public Utilities James Mathis announced this week that city water plant number two is back in full production and that permanent construction of two air stripping columns had been completed.

Mathis produced a report by Environmental and Safety Designs, Inc. of Memphis that showed considerable amounts of trichloroethene, or TCE, in raw water from the west well at the plant. Tests run in April showed 19 parts per billion of TCE in raw water, but amounts below detection levels in treated water. In May the raw water showed a slight decline of TCE to 17 parts per billion with no TCE apparent in treated water.

Two tests were run in June prior to final acceptance by the Tennessee Department of Health and Environment. Those tests showed [illegible] of TCE in raw water from the west well. A [illegible] showed 22 parts per billion of TCE in [illegible] from the same well. [illegible] public [illegible] water 1.3 parts per bi[illegible]

TCE [illegible] have contaminated [illegible] two [illegible] greaser at the Carrier [illegible] south of the well site. The spills were in 1979 and 1985. Since that time, the Carrier site has been added to the EPA's Super Fund list. Carrier has agreed to pay for installation of the stripping towers. TCE is believed to cause cancer.

TCE was detected in the wells

Continued On Page 8

No TCE

Continued From Page 1

in August of 1986 when levels in finished water reached 5.25 parts per billion. At that time the wells were closed. In August of 1988 the wells were reopened with new stripping equipment added. By March of 1989 TCE levels in the treated water had risen to as high as 9.2 parts per billion and again the wells were closed. In March of this year new temporary air stripping equipment was installed.

Mayor Herman Cox reassured residents that no contaminated water ever got into the city water system. During the water crisis the city has been working on a new water plant to keep up with heavy demand and to supplement the lost well's output. Mathis announced that the new plant was nearly completed and ready to go on line in time for heavy summer demands. In 1988 the city asked residents to voluntarily cut back on water consumption by watering on alternate days.

Mathis said that recent dry weather has brought increased demands on the city system. According to Mathis, peak use in 1987 was 4.073 million gallons per day. The peak in 1988 was 4.6 million gallons per day, with the peak in 1989 at 3.4 million gallons per day.

Mathis reported the city had peaked in their water use to 4.6 million gallons on Monday, July 9. According to Mathis, the last measurable rainfall was June 22.

Carrier
13.7
Date: 5/17/90

EPA Investigates Career TCE Spill

COLLIERVILLE—EPA officials, city officials, and local residents met last Tuesday to discuss the investigation and the clean-up of the Carrier TCE spill that has plagued the Collierville water wells at the Byhalia Road water plant.

EPA officials set the public forum to update residents on the situation and hear residents' concerns. Officials explained that the first phase of the investigation has been completed and a long-term groundwater monitoring program has been initiated.

TCE (trichloroethylene) was first believed to be leaked into the groundwater at Carrier's Byhalia Road plant in 1972 when the company began operating an unlined lagoon for the purpose of containing clarifier sludges. EPA officials said the TCE apparently leaked into the groundwater from the lagoon. In 1980 Carrier removed all visible wastes and soils from the lagoon and transported them to a hazardous waste disposal facility.

In June of 1979 EPA officials estimate that several thousand gallons of TCE collected on the plant's south parking lot after a spill of the degreasing solvent. TCE was again spilled at the plant in January of 1985 and while [illegible] gallons were recovered, company officials said they did not know how much was spilled.

At Tuesday's public meeting EPA's Beth Brown said the second phase of the investigation and clean-up will commence in June with additional monitoring wells and a biological study.

Residents were also informed that a repository of information on the site has been established at Collierville's Public Library at 91 Walnut Street. There, residents can obtain information on the Carrier site and laws that will govern the clean-up procedure.

Mayor Herman Cox, Aldermen Sidney Turnipseed, Tom Brooks, John Meeks, and Jimmy Lott, and City Administrator Steve Schertel were joined by Collierville's Public Works Director James Mathis representing the town at the meeting. EPA officials Harold Taylor, Beth Brown and Michael Henderson were also on hand as well as a group of concerned citizens.

Independent
Thursday, May 17, 1990
Serving Collierville · Rossville · Piperton · Moscow · Eads · Fisherville · Byhalia · Cayce TN

Carrier
13.7
3/3/90

INDEPENDENT
THURSDAY, MAY 3 1990

EPA Sets Meeting On TCE Contamination

by ROBERT McCARTY
Associate Editor

COLLIERVILLE — Representatives from the Environmental Protection Agency will be in Collierville Tuesday to hold a public meeting on the Carrier Air Conditioning Company's spill of trichorcethylene (TCE) at the Byhalia Road plant.

EPA officials will be at Collierville's Town Hall at 101 N. Walnut Street on Tuesday, May 8 from 7 p.m. to 9 p.m.

The Carrier plant has been placed on the EPA's Superfund site list as the result of two separate spills of TCE. In June of 1979 several thousand gallons of the commercially used solvent and degreaser was spilled when a filter cover over a heated degreasing unit failed to operate properly.

TCE again escaped in January of 1985 when an underground line from a TCE holding tank ruptured. It is unclear exactly how much TCE was spilled in the 1985 incident.

Since the 1985 spill, Carrier has installed five monitoring wells and the Town of Collierville and the Tennessee Department of Health and the Environment has monitored TCE levels.

The Town has twice shut down wells at the Byhalia Road water plant in response to rising TCE levels at that site and recently both wells at the Byhalia site have been reopened with additional treatment equipment in use. The aeration equipment now in use at the site has allowed the Town to reopen both wells at the Byhalia Road Water Plant.

After a long-term groundwater monitoring program was initiated and sampling has been completed, measurable amounts of TCE in the soils and smaller amounts of TCE in the groundwater at the site. No measurable contaminants were found in the air.

Under a consent order agreed upon by Carrier and the EPA, Carrier has agreed to conduct a remedial investigation and a feasibility study to examine various measures to correct or control the contamination.

The Carrier site has been listed on the Tennessee Department of Health and the Environment's list of hazardous substance sites since March of 1987 and in June of 1988 the site was proposed for inclusion on the EPA's National Priorities List. The National Priorities List indicates that EPA officials feel preliminary investigations indicate that the TCE spill poses "a potentially serious risk to public health and/or the environment," according to a recent press release from the EPA.

All sites listed on the National Priorities List qualifies for the Federal Superfund program. The Superfund law authorizes the EPA to investigate releases of hazardous substances that may endanger public health or the environment. Since Carrier will be conducting the investigation and the clean-up at the Byhalia Road site, the EPA will oversee all work done at the site to ensure that the work is done in accordance with the law.

Additional information on the Carrier site has been made available by the EPA and is on display at Collierville's Public Library at 91 Walnut Street. Copies of applicable laws, work plans for the remedial investigation, and the EPA's plan to keep the public informed are all avail-

THE COLLIERVILLE HERALD
APRIL 26, 1990

Superfund Hearing Is May 8

The Environmental Protection Agency will hold a public meeting Tuesday, May 8, at 7 p.m. to provide information to Collierville residents about the investigative work EPA will be doing this spring at the Carrier Air Depot Superfund site.

Carrier spilled TCE at the Byhalia plant several years ago and TCE has appeared in unsampled water from the two wells at Collierville's Byhalia water plants since that time.

Both wells were shut down when TCE levels rose above acceptable limits. Use of a borrowed aeration tower for one well has dropped the TCE level below the traceable level at the Byhalia plant.

THE COLLIERVILLE HERALD
Serving the county since 1870.
Vol. 120 No. 15
Thursday April 12, 1990

Carrier
B.F
4/12/90

Plenty of Good Water Is Coming to Town

Collierville will soon be awash in clean water. By mid-June, if the Frank Rd., water plant is on schedule, the town should have six water wells capable of pumping 9.6 million gallons of waters a day, according to Public Utilities Director James Mathis.

The "borrowed" air stripper which is being used to strip TCE from a well at the Byhalia Rd. water plant has produced finished water that has no trace of the pollutant, Mathis said. He said the raw water tests 25 parts of TCE per billion, with .14 parts per billion after it comes from the stripper before going into the final aeration.

He said he expects State Health Department clearance for use of the water in the next 10 days.

The plant will eventually have two custom built twin air strippers which will allow both wells at the plant to be activated. Mathis said he hasn't been given a definite delivery date on the strippers but they should be here by early May and in service about a week later.

Collierville's water system provided 4.5 million gallons of water on its peak day, June 8, 1989. At that time the system had 4,324 customers. The system now has 4,888 customers, Mathis said.

V 9, No. 38 Thursday, April 12, 1990

Independent

Serving Collierville•Rossville•Piperton•Moscow•Eads

New Tower Takes TCE Out Of Water

COLLIERVILLE — A new air stripper, installed temporarily at C rville's water plant #2, is now capable of aerating 400 gallons per minute, said Ensafe Chemical Engineer Craig A. Wise in a recent letter to Bill Hench of the Tennessee Department of Health and Environment.

Wise said the amount was enough to allow the city's system to operate at design capacity. In his letter, Wise said the stripping column would reduce TCE (trichlorcethene) concentrations in the finished water to 1 part per billion or less, well below the 5 part per billion drinking water standard.

A permanent system should be operating by the first of May with final testing and acceptance by Carrier Corp. and the city of Collierville near the end of June. Carrier is footing the bill for the towers after being included on the EPAs Super Fund list targeting areas for environmental cleanup.

Carrier experienced two spills of TCE at its Byhalia Rd. plant, one of 2000 gallons in 1979 and one of 500 gallons in 1985. Water plant number two is located just north of the Carrier plant, and had been closed since concentrations of TCE reached as high as 31 parts per billion in untreated water in January of this year. Treated water yielded TCE amounts of 5.9 parts per billion, unacceptable for public drinking water.

Monday night city administrator Steve Schertel told the Board of Mayor and Aldermen that tests of water coming out of the air stripping tower produced readings of .14 parts per billion of TCE, and that the city could find no trace of TCE in treated water coming from plant number two.

Independent
Serving Collierville • Rossville • Piperton • Moscow • Eads • T
Thursday, March 29, 1990
Vol. 8, No. 36

Stripping Towers Installed To Remove TCE

by ROBERT McCARTY
Associate Editor

COLLIERVILLE — New water treatment equipment is being installed at Collierville's water plant on Byhalia Road this week and officials are hoping that the improvements will allow them to re-open the water plant by this summer.

The Byahlia Road plant was closed in February when increasing levels of TCE (trichloroethylene) were uncovered in the water supply. Two TCE spills at Collierville's Carrier Corporation are believed to have contributed to the contamination and Carrier has agreed to pay for the installation of one temporary water treatment tower and two 30-foot air stripping towers.

Collierville Director of Public Utilities James Mathis said the concrete pad for the towers wa completed early this week an installation of the temporar tower, which has been shippe from Carbonair Services Inc. i Hopkins, Minn., was underwa Tuesday.

The temporary treatment sys tem will allow the Town t re-open one of the two wate wells at the Byhalia Road site When the Town shut down bot of the wells in February som complaints of low water pres sure were received from th west end of town. The Tow was forced to rely on th downtown water plant for all o the City's water. While only few complaints were registered City officials were concerne that the Town might hit a rea water crunch during this sum mer's peak usage periods. Bu now officials are confident tha the two water stripping tower plus the opening of a new wate plant on Frank Road will satisf the Town's water needs thi summer.

City Administrator Steve Schertel explained that the two towers will work as an aeration system in which the water is pumped to the top of the towers As the water falls through a series of filters, blowers push air through the water and re move the TCE.

Schertel said the system is supposed to be 98 percent ef fective in removing TCE. TCE is a suspected carcinogen.

Workers were busy Tuesday installing new water treatment equipment at Collierville's water plant on Byhalia Road. The aeration tower is designed to remove TCE from Collierville's water supply and officials are hopeful that at least one of the town's two wells at the site will be reopened soon.

Carrier
13.7
3/21/90

Carrier official assails Gore on priorities

By James W. Brosnan
The Commercial Appeal
Washington Bureau

WASHINGTON — A Carrier Corp. lobbyist charges Sen. Albert Gore Jr. (D-Tenn.) let his environmental agenda and presidential ambitions get ahead of the interests of Carrier's 2,500 Tennessee employees.

The comments by Ted Baily, vice president for government affairs at the Carrier Corp., were prompted by the recent passage of a Gore authored amendment to the pending clean air bill. The amendment restricts a chemical harmful to the Earth's protective ozone layer.

It would freeze production levels, starting in 2015, of the coolant that Carrier and other manufacturers put in air conditioners. All uses would be halted in 2030.

Gore's amendment was approved by the Senate 80-16 on March 8 before it adjourned for a weeklong recess. Debate on the bill resumed Tuesday.

The Carrier plant, which makes central residential air conditioners, is Collierville's biggest single employer with 1,110 workers there. Carrier also employs about 450 Tennesseans making parts at a Knoxville plant and about 800 making commercial air conditioners at a McMinnville plant.

"I think Senator Gore is running for president on environmental issues. That has more to do with his decision, perhaps, than on how best the country deals with the problem," Baily said.

Gore denied Baily's accusation and said he was "too generous" in the time he gave companies to stop using the chemical. "These people are saying they can't come up with substitutes in 40 years?" he asked.

Scientists agree that chlorofluorocarbons used as coolants are destroying the ozone layer and increasing the risks of skin cancers, cataracts and other medical disorders.

But the chemical used by Carrier to put the "chill" in its air conditioners is a hydrochlorofluorocarbon, known commonly as HCFC 22, that is a substitute for a chlorofluorocarbon, CFC 11. According to government scientists the substitute is 20 times less destructive to the ozone layer as CFC 11.

But those scientists also warned in congressional testimony that ozone-depleting chemicals still will more than double in the atmosphere if CFCs are replaced by HCFCs.

Baily also said he was "disappointed" but "not surprised" that Sen. Jim Sasser (D-Tenn.) supported the Gore amendment. Baily had contacted aides to both senators.

Sasser spokesman James Pratt said Sasser recognized industries' concerns, but concluded the ban on ozone-depleting chemicals should be comprehensive and that alternatives will be available.

If he's wrong, air conditioner sales could be hurt and Tennessee jobs could be lost, said Baily.

Baily said Carrier also could lose markets abroad to foreign companies not bound by the chemical ban.

That's why Carrier and other home appliance manufacturers believe the United States should wait on an international agreement to determine when ozone-destroying chemicals are phased out.

...IERVILLE HERALD
Serving the county since 1870. Thursday March 15, 1990

Town's Water System Gets Approving Nod

The town's water system is "approved."

Despite a recent water crisis which left the town operating out of two wells at the Main St. plant, the town's waterworks system received a numerical rating of 91 by the Tennessee Department of Health and Environment in a late February evaluation.

The favorable rating comes as Collierville awaits a temporary aeration tower, due to arrive in town this week, which will allow the Byhalia Rd. plant to become operative after being shut down for a number of months because of high levels of TCE.

Drilling a second well for the incomplete Frank Rd. water plant was approved by the Collierville Board of Mayor and Aldermen Monday. Layne Central was awarded the contract at a cost of $136,549. A site for the second well has not been bought, but City Administrator Steve Schertel said the town is negotiating for a site on Shelton Rd.

The Frank Rd. plant is expected to be operative in early summer.

Edmond B. O'Neill, manager of the health department's Jackson Basin office, said the town will have to start supplying 15 microbiological samples per month, two more than now required, because of the town's population increase.

O'Neill also recommended the aerator reservoir at the Main St. plant be cleaned and painted, and that an updated overall system distribution map be submitted to his office.

THE COLLIERVILLE HERALD

120 No. 10

Serving the county since 1870.

Thursday March 8, 1990

Water Tower to Arrive Next Week

The temporary aeration tower for the Collierville Byhalia water treatment plant will be shipped from Hopkins, Minn., Friday and will arrive next week, James Mathis, director of public utilities, said.

"We will build a support slab and do pipe work for the temporary tower," Mathis said. "We will do this as soon as the engineering drawings are in place.

"It will only take two days for the installation, and we should have the temporary tower in service before the end of the month."

Two full size units are being manufactured for Collierville and should be available in about two months.

A gift of $280,000 from Carrier Corp. is being used to rehabilitate two wells at Collierville's Byhalia water treatment plant. This will allow the plant to be put back in service before the end of March, Mathis said.

The wells were closed Feb. 6 after sampled water reached an all-time high level of TCE. The petroleum based cleaning agent was first found in the wells several years ago. TCE spills have been reported from the Carrier plant near the wells, the latest having been in 1986.

Mayor Herman W. Cox said Carrier voluntarily approached the city and offered to pay for all needed improvements.

The towers will return the plant's production to 1.4 million gallons a day.

Site: Carrier
Break: 13.7
Other: 3 FTS

Nonconnah contains dioxins

Federal studies find high level of contamination

By Tom Charlier
The Commercial Appeal

Fish from Nonconnah Creek in Memphis contain some of the highest dioxin levels ever found in Tennessee and could pose a cancer risk to people who eat them regularly, say federal studies released Tuesday.

As part of a nationwide program to measure chemical contamination, researchers found dioxin in catfish and carp taken near the mouth of the creek at McKellar Lake.

However, health officials believe few contaminated fish are being eaten by humans locally. For years, state officials have issued advisories against the consumption of fish from McKellar and adjacent areas of the Mississippi, and commercial fishing there remains banned.

The federal studies, which include testing at 400 sites across the nation, did not attempt to find a source for the contamination. However, the Nonconnah location for the sampling was selected because it is below MAPCO PETROLEUM Inc.'s refinery on West Mallory — a facility officials believe could generate dioxin.

Dioxin is the generic name given more than 200 chemicals that include some of the most toxic artificial compounds. Some types are so virulent to animals, particularly rainbow trout, that barely detectible levels can cause fatal tumors.

The chemicals' effects on people remain largely unknown, but the U.S. Environmental Protection Agency considers dioxin a probable human carcinogen.

Marshall Hyatt, an environ-

From Page B1

Creek

cal of what we've seen" during five years of dioxin testing across the nation.

The key finding from the local samples taken last August was that catfish fillets contained an average concentration of 7.23 parts per trillion of dioxin. That's higher than any other fillet measurements from three Tennessee sites included during the most recent round of testing, but far less than some previous samples taken from the Pigeon River near the Tennessee-North Carolina border.

The EPA said a person who eats a yearly average of five pounds of fish containing at least 7 parts per trillion of dioxin increases the risk of cancer by 0.01 percent, over a 70-year lifetime.

Rick Sinclair, deputy director of the Tennessee Department of Health and Environment's Division of Water Pollution Control, said that although the findings are troubling, he'd like to see more sampling before arriving at a conclusion about the extent of the problem.

He said it's impossible to determine the source of the dioxin. The Nonconnah receives surface runoff from South Memphis industries including MAPCO, Refined Metals Corp. and American Resource Recovery Corp. The companies generally have been in compliance with their discharge permits, but the permits do not require testing for dioxin.

However, Hyatt and Sinclair said MAPCO is a possible source. They said recent studies in Canada found refineries using processes similar to MAPCO's can generate dioxins.

Robert Alexander, MAPCO's vice president for refining, said he's heard of the Canadian studies but knows of no dioxin problems at the Memphis refinery. The facility sends most of its wastewater into city sewers, with surface runoff funneled into Nonconnah and McKellar.

"I don't have any reason to believe that dioxins are coming from anything that we're doing," Alexander said.

The results released Tuesday involved 10 sites in six Southeastern states. The highest dioxin measurement in fish fillets was 22.8 parts per trillion, found in striped bass in the Big Sandy River at Catlettsburg, Ky.

MEMPHIS, WEDNESDAY, MARCH 7, 1990

METRO

THE COMMERCIAL APPEAL

SECTION B

Carrier 137

THE COLLIERVILLE HERALD

Vol. 120 No. 7 Serving the county since 1870. Thursday February 15, 1990

Studies Set For Route To I-40

Corridor and environmental studies for an improved route from Collierville to Interstate 40 will begin soon. The proposed route will take the general direction of Collierville-Arlington Rd. (State Route 205) from Collierville north to I-40, according to Howard Wilson, transportation director for the Tennessee Department of Transportation.

Wilson told The Herald 17.6 miles of road from Collierville to I-40 would eventually connect with Paul Barrett Parkway, which will run from

One Water Plant Closes -- But No Shortage 'Yet'

By Daisy Fontaine

Elevated levels of trichloroethylene (TCE) in two water wells at the rear of the Carrier plant, where a TCE spill has occured, caused Collierville to shut down Water Plant No. 2 on Byhalia Rd. But City Administrator Steve Schertel said Water Plant No. 1 on Main St. produces enough water per day to meet the town's needs through February.

James Mathis, director of Public Utilities, said no contamination has been found in Water Plant No. 1 on Main St. The two wells there are the sole source of water for Collierville at this time, he said, along with stored water in a reservoir on Distribution Parkway.

The addition of two new wells for Water Plant No. 3 on Frank Rd. will give the town a net increase of 3.6 million gallons of water a day and more than enough water. The Frank Rd. facility is under construction, but one of the wells can be put in service in March.

There is no need for Collierville citizens to conserve water in the immediate future Schertel said. If there is an abnormal delay in opening the Frank Rd. plant near the Collierville Middle School, conser

Continued on Page 2

High School and Middle School To Swap Sites, Under New Plan

By Clark Porteous

The plan is for this to be done ton High." James Hayslip school board and the county on the plan

Water Plant Closes—No Shortage Yet

ntinued from Page 1

n may become necessary, he said.

A well near the Shelton Rd. waste treatment plant will supply the water for the plant initially. The Collierville Board of Mayor and Aldermen has already approved the early start of a second well which will also supply the Frank Rd. plant. Ben White, engineer for the project, said the well will cost around $100,000 and was budgeted in the bond issue which funded the Frank Rd. plant. However, it was not expected the well would be needed so soon.

"Time is very critical in this matter," White said. He hopes to have the Frank Rd. facility ready on a temporary basis in early March and fully operational by July "if all goes well."

The town's fire fighting capacity has not been threatened, Schertel said. State requirements are 20 pounds of pressure per inch at the taps. He said all plugs tested have been found to have 40 pounds of pressure per square inch. However, residents in some parts of town, especially the west end, may experience low pressure during peak use periods.

Schertel said he made no announcement about the closing of the plant until Monday because the town got only oral indication of the rise in the TCE from ENSAFE, Carrier's environmental laboratory, Feb. . On Feb. 7 he said the west well, which had been closed down since October because of rise in contamination, was turned onfor a test. "Samples were taken and oral statements of too high contamination were received on Friday. It was obvious late Friday afternoon that both wells (at the Byhalia la would have to be closed. w unable to get in touch with members of the Collierville Board of Mayor and Aldermen until Monday in order to confirm the closing of the wells," Schertel said.

For a number of years the contaminant has been found in water coming from the Byhalia plant, adjacent to the spill site at Carrier Plant on Byhalia Rd. But the contaminant level has never gotten so high. Several TCE spills have been reported by the plant, the latest in 1986. The spill area has been declared a Super Fund site by the Tennessee Health Department and the Environmental Protection Agency.

Levels of TCE in both wells at the site have been continually rising since October, Schertel said, but treated water delivered to Collierville users has never gone above Tennessee Health Department's allowable level of 5 parts per million gallons.

TCE levels in the east well at the Byhalia plant were monitored at 12 parts per million in October, 15 in November, 25 in December and 31 in January. Treated water in that well registered 4.5 per million gallons in January.

Schertel said the west well, when tested Feb. 7, produced treated water with a TCE level of 8.9.

White said of the plant, "There is no quick fix. The state and EPA will have the say about when the plant should reopen and that will take time." He estimated the plant will be down about a year.

When asked why the plant should not be permanently closed, he said, "I hope it's not shut down permanently. So does the health department – for two reasons. The plant is needed in that spot. It is in a good position to serve the area, including Delta Beverage Group (which will begin a large expansion program across the street from the water plant in early spring).

"The other reason is that it is advantageous (according to the health department) to keep the wells pumping so the TCE concentration will be drawn to one area and treated there." White suggested taller aeration towers could improve removal efficiency and put the wells back in compliance.

One scientific explanation for the sudden rise in the TCE levels is that the residual contaminants were washed into the water table after the ground, frozen to a level of halfa foot for two weeks, thawed and became friable and allowed the release of the pollutant.

by County.
Perkins said
meeting of Co
Morris' execut
the Task Force
was mainly a
meeting. The
be at the Men
vention Center
day, Feb. 23.

Perkins, wh
a comprise pl
school consolid
sy, said it toc
restructure cou
in the 1970s a
take a signifi
time" to settle
tion.

Mayor Mor
group Jan. 26
conflicts over
merge city an
systems, a pr
caused county
ers to oppose th
ly and even to
threaten splitt
two counties
consolidation.
was chairman
and said the tas
find a compromi

Pistol Go

A pistol which
f Moscow, had
parents' home a
ley is missing,
reported to pol
time between Oc
someone had tak

Current 2/14/90

THE COMMERCIAL APPEAL

Collierville may limit v

By Clay Bailey
and Tom Charlier
The Commercial Appeal

Collierville will have only one water well in operation through July. Residents may face water rationing if there is a dry spring.

Collierville closed its Byhalia Road water plant Feb. 6 when unacceptable levels of a carcinogen, trichloroethylene (TCE), were detected in its water supply. TCE is a solvent used for dry cleaning and removing grease.

Helyn Keith, pollution control manager for the Health Department, said the Collierville contamination does not appear to be a threat to the water supplies of Memphis and other Shelby County communities. "We feel like it's very localized," she said.

Officials in the eastern Shelby County town of 16,000 had hoped to ease a potential water shortage by using water from the Frank Road reservoir while a water treatment plant was built at the site. But City Administrator Steve Schertel said he learned late Monday night that the reservoir is not usable until plant construction there pleted in July.

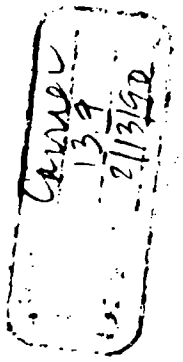
A state official, mea said the increase in co ant levels "is not all th ing a development."

O'Neill, field offi ager for the Departm Health and Environmen sion of Water Supply in J believes the TCE infiltra groundwater from an ol by Carrier Corp. waste po chemical apparently mo ly through soil and clay

"I assume what's happ ... that stuff soaked i groundwater and the

METRO

MEMPHIS, TUESDAY, FEBRUARY 13, 1990 THE COMMERCIAL APP



Collierville shuts water p after chemical level incre

By Clay Bailey
The Commercial Appeal

Collierville has shut down one of the town's two water plants after discovering increased levels of a suspected carcinogen.

Collierville City Administrator Steve Schertel said Monday the closing of the Byhalia Road treatment plant a week ago came after both of the plant's wells showed increased levels of trichloroethylene (TCE), a solvent used in dry cleaning and the removal of grease.

He emphasized that no water with a dangerous amount of TCE has been distributed to Collierville water customers.

Schertel said the town's remaining downtown plant can produce enough water for Collierville over an entire day, but some of the town's 16,000 residents, particularly those on the west side of town, could experience decreased water pressure during peak demand hours.

He said the city had received one complaint about inadequate water pressure since the plant was closed Feb. 6. The town is not imposing any cutbacks in water use because of the shutdown, Schertel said.

The TCE first was discovered in August 1986 and is suspected to have come from the nearby Carrier Corp. plant. The contaminant was detected in the water system during a follow-up investigation to a 1985 TCE spill at Carrier, Collierville's largest employer. In 1986, Carrier officials confirmed there had been two TCE spills at the plant since 1979.

Collierville continued to use one of the wells at the Byhalia plant because the amount of TCE in the treated water customers used was well below the 5 parts per billion state health officials consider dangerous.

But over the past several months, the level in both the treated and
creased. In
said, there w
lion in the u
January tests
ficials reveal
lion in the
parts per bil
ter.

Schertel sa
cials tried to
at the Byhali
tests showed
in the untre
parts per bi
treated — we
levels.

The town
treatment pla
tion on Frank
ating in July
increased sun
the meantime,
receive a te
from the stat
from a new we
to an existi
Frank Road a
water for distr

Carrier
13.7

Super Fund Site May Carry Road

The Environmental Protection Agency will hold a public meeting in Collierville to discuss the Carrier Super Fund site in the near future, according to City Administrator Steve Schertel, but a date hasn't been set.

The city is interested in using the site, along the north edge of Carrier property, west of Byhalia Rd., as right of way for an extension of S. Rowlett, Schertel said.

He and a delegation from the Collierville Board of Mayor and Aldermen visited the offices of the Tennessee Division of Health and Environment, Division of Super Fund in Nashville last Thursday.

The agency told the group that there doesn't appear to be any threat to the health, safety and welfare of the community in the area where trichloroethylene was spilled several years ago. "They just are exercising cautious concern," Schertel said. "A Super Fund site is not meant to stop good ideas. You're just a little more cautious with them."

When the EPA meeting is held here they will be talking to people of the community and checking on the test sites which have been dug for testing in the area, he said.

Vol. 8, No. 29
Thursday, Feb. 8, 1990
16 PAGES IN TWO SECTIONS

Carrier 13.7

EPA To Check Wells For TCE

COLLIERVILLE — The EPA will be checking private wells within a one to three mile radius of the Carrier Corp. as a part of the ongoing investigation of the TCE leak in the water system there. However, according to Felicia Barnett, a remedial project manager with the EPA, investigators do not expect to find private well endangered by any TCE contamination.

TCE (Tetracholoethyene) is an industrial degreaser that began showing up in the raw water at the city's water plant no. 2 in December of 1988. At that time the wells were closed. In March of 1989 TCE levels had reached as high as 9.73 parts per billion in untreated water. The allowable level is 5 parts per billion according to government standards. In April of 1989 the city installed $20,000 in scrubbing equipment bringing the TCE level in treated water to .5 parts per billion. The TCE came from two spills at the Carrier plant, located south of the well sites. The spills were of 2000 gallons in 1979 and 500 gallons in 1985.

According to Barnett, because the city well is so close to the Carrier site, and because it draws such a large amount of water, not much water escapes the area to ever enter private wells. Normally wells within a one to three mile radius would be checked, depending on the ground water flow. The closer wells will probably be checked first. If, as suspected, nothing is found in these, investigators would not check the ones further away, since that would also rule out any contamination in those.

Within the next two weeks EPA officials will meet with representatives from the city and Carrier to discuss getting information out to the public. According to Barnett, a site, possibly the library, will be set up complete with documents acquired through the state investigation, and telephone numbers where more information can be acquired. These would be available to the public to read and to copy. It is anticipated that this public access center would be set up within one to two months, no later.

The public wells are routinely checked by the state and city to insure that TCE levels are acceptable.

Water Woe To Be Solved

$280,000 Carrier Gift Pays Cost

By Daisy Fontaine

A gift from Carrier Corp. of some $280,000 for rehabilitating two water wells at the town's Byhalia Rd. water treatment plant will allow the plant to be put back into service by about Mar. 12, according to Mayor Herman Wright Cox. The gift is the result of a Monday meeting which included Cox, City Administrator Steve Schertel, members of Collierville's engineering firm, Fisher, Phillips, and Arnold, and Carrier Corp. executives. The wells are located behind the Carrier plant and are contaminated by trichloroehtylene (TCE), spilled there several years ago.

The wells were closed Feb. 6 after sampled water reached an all-time high level of TCE. The petroleum-based cleaning agent was found in the wells several years ago. TCE spills have been reported from the Carrier plant near the two wells, the latest in 1986.

Continued on Page 3

A crowd gathered, including police and paramedics, when the 1988 Honda, driven by 15-year-old Jessie Whitten, crashed into the white 1988 Toyota Corolla of Elaine Walker, pushing her car into a 1981 Oldsmobile driven by John Nelson on Main at Poplar. No one received major injuries.

15-Year-Old Driver In Wreck

Jessie Whitten, 15, of Collierville, was charged with opposing traffic, driving without a license, and making an improper right turn when he made too wide a right turn onto Main St. off of Poplar Feb. 15, and precipitated a three-car pile up, according to Collierville Police.

Whitten, westbound on Poplar, hit the car of Elaine Walker, 23, of Cordova, which was stopped on Main in the left turn lane awaiting a change in the traffic signal; and Mrs. Walker's car was pushed into the car of John Nelson, 28, of Rossville, which was in the right turn lane on Main, police said.

Mrs. Walker had minor injuries to the left side of her head, police said.

Houston Named President Of First Tennessee Bank

.Randy Houston is the new president of First Tennessee Bank, Collierville. He fills a position that has been vacant since last fall.

Houston joined First Tennessee in 1972 and was a vice president in the bank's finan-

"My wife, Ginger, and I are looking forward to getting involved in this community," said Houston. "Collierville has a lot going on, and this is an exciting time to be here. People are the key to success in banking, and here at First Tennessee, Collierville, we have a

Former Vice Mayor Found Unconscious

Carrier 13.7 million

The Collierville Independent

arles K. Bassett, a pilot with Federal Express, orman's fourth grade class at Collierville Ele- id talked with the students about pilot equip- s, and treated them to a film of the infamous Air Force Thunderbirds. Fourth-grader Starry s student volunteer.

ıt-Down of Party

(ootie Madi- relations abody, said eed to have on hand as ne showed ıvailable, in rity guards,

principal, l he had no ned at the out of hand. ority is not school, and do with the lso said he ls from par- heir anger r teenagers

sphere.

The incident came in the same week that Juvenile Court officials released figures showing that students at Germantown High School faced more alcohol-related charges than those at any other school in Shelby County.

Several seniors, who wished to remain anonymous, said the party wasn't supposed to be like that. They said underclassmen trying to show off caused most of the chaos. Several of the seniors said they are worried now about whether they will be allowed to have a prom. And, they are worried about the future reputation of Germantown High School.

Town Water Problem Will Be Corrected

Continued from Page 1

A temporary aeration tower to be installed first will be used to put the plant in opeation by Mar. 12. Schertel said the tower should be in the city by Monday.

Two air stripping towers, measuring 30 feet in height by five feet in diameter, will be installed permanently and should be in operation by May.. The towers are described by Ben White, engineer for Fisher, Phillips, and Arnold, as the most effective, simplest and least costly process for removal of TCE.

Cox said, "The town will not bear any of the cost. Carrier Corporation voluntarily approached us and offered to pay for all needed improvements."

White told The Herald that the taller aeration towers at the Byhalia plant will remove 98 percent of the TCE in the water. He said both the Tennessee Department of Health and Environment and Carrier Corp. would like to hav wells operational becaus TCE concentration wil drawn to that area and tre

The towers will return plant's production to 1.4 mi gallons of water per day.

"Tennessee Departmen Health and Enviroment is aware of the situation and agreed to expedite approv the plans. While all work be completed by firms ur contract to Carrier, the w will be inspected and appr by the town's engineering fi Schertel said.

The town is currently ope ing off three wells at the M St. plant, with a total capa of 4.17 million gallons per James Mathis, director of P lic Utilities, says the wells h not been taxed so far. The toric peak for water output been 4.6 million gallons day, he said, and that was ing a drought.

Mathis said, "Any water s ply can be cleaned to the p that it is safe to drink and g tasting. With this enhancem to our system, we will be abl produce treated water wh far exceeds federal, state local standards."

The city will have a tota seven wells with a maxim flow of nine million gallons day when the Frank Rd. pla with two wells, goes on line p manently. White said the pl should be operative in Ju with temporary use expected early March.

Mathis said he has had o one legitimate complaint ab low water pressure since t city's water production h been limited to the Main plant. He said two or thr other complaints in the nor ern sector of the town proved be partially closed meter val at the homes.

"We are more than ju happy with Carrier," said C "We were in trouble, facing p sible water shortages and t prospect of slower growth f our community. They are go corporate citizens."

83 Teen Alcohol Cases Reported

Continued from Page 1

lierville Middle School. He again attributes that low number to the fact that some of these people live outside Collierville.

Juvenile Court statistics showed Germantown High the county leader in alcohol violations with 122.

Other leaders in order were: CBHS, 52; Kirby High School, 27; Ridgeway High School, 26; Briarcrest High School 24; Millington Central and Raleigh-Egypt High, 21; MUS, 19; Bolton High School 18; White Station High and College/University School, 17; Craigmont High, 16; Central High, 15; Kingsbury High 13; Bartlett High and Overton High, 12.

Germantown High had only 23 drug violations. Memphis inner city schools were leaders in drugs. Humes was the leader with 67 violations.

COMMERCIAL APPEAL

Memphis, Tenn., Tuesday Morning, September 9, 1986

Traces of solvent are discovered in Collierville's water supply

No tainted water reached customers

By Clay Bailey
Staff Reporter

Water tests conducted by Collierville and state health officials have revealed traces of a solvent in one of the city's water sources, but apparently none of the contaminated water has reached the town's water customers.

State health officials would not confirm the contamination by trichloroethylene, a solvent used in dry cleaning and the removal of grease, but a press conference on the subject is scheduled for today.

However, Collierville officials confirmed last night that TCE was found in two wells at the town's water well field near Byhalia Road when the tests were conducted last month and last week. The contaminant affects one of the wells and possibly a second.

The contaminant was found in the "raw" water in the wells, said City Administrator Jay Johnson and Mayor Herman W. Cox, but the treatment process apparently eliminated it. They were uncertain how the solvent got into the wells.

"The treatment process includes lime, chlorine, fluoride and aeration," Johnson said. "It apparently is removing the contaminant."

Town officials stressed there is no indication of TCE in the water system or in water distributed to the public after regular treatment processes.

Cox and Johnson said one of the wells near Byhalia Road has been shut down except for testing purposes since the city learned of the problem. They said the city also has begun tests to try to find an adequate well in another area of the city. If the

Please see COLLIERVILLE, Page A12

From Page A1

Collierville

town finds an adequate water supply, there could be an emergency meeting of the Board of Aldermen to fund the project.

Collierville has two well fields that serve residents — the field near Byhalia Road, south of Poplar, and one in the downtown area. The downtown water fields are the primary source of the town's water supply, but growth has pushed the system to the point where the Byhalia wells are operating much of the time.

Testing on some private wells in the area will begin today, Johnson said.

Dr. Peter Czajka, director of the Southern Poison Center and associate professor of clinical pharmacy at the University of Tennessee at Memphis, said studies have indicated there is little risk of TCE causing cancer. Although one study found that TCE caused cancer in laboratory mice, he said other studies, including one involving rats, found no cancer risk.

Dr. Czajka said TCE, when diluted in large amounts of water, poses little threat of poisoning. Concentrated, it can produce symptoms including skin irritation, rashes, a flushing sensation on the skin, headaches and nausea, he said.

Shelby County health officials said yesterday they had received no official contact from anyone on the possibility of contaminants. Richard Swiggart, acting director of the Health Department, was concerned about the lack of information his office received on the sampling.

"We would like to be involved in the investigation and identification of the problem in order to determine the extent of the contamination," Swiggart said late yesterday afternoon.

"If there is to be any sampling of private wells in the community, it is our intent to participate and if that's impossible we will mount an investigation on our own."

ATTACHMENT D

PUBLIC INFORMATION MEETING
FOR THE
CARRIER AIR CONDITIONING
SUPERFUND SITE

Thursday, April 30, 1992
7:00 p.m.
Memphis/Shelby County
Public Library
91 Walnut Street
Collierville, Tennessee

WEBER, MORROW, OATES & SANDERS
COURT REPORTERS
Suite 1410 - 165 Madison Avenue
First Tennessee Bank Building
Memphis, Tennessee 38103
(901) 528-1168

PROCEEDINGS

(April 30, 1992; 7:00 p.m.)

MR. TAYLOR: First of all, I would like to welcome everybody to the Carrier meeting tonight. I know it takes away from your personal time to come to public meetings like this. We appreciate you coming. I hope we can answer the questions that any of you may have tonight.

My name is Harold Taylor. I am the Chief for the Tennessee/Kentucky Remedial Section of the EPA, Environmental Protection Agency, Region IV. Our offices are headquartered in Atlanta, Georgia. There are ten regions across the United States in the Environmental Protection Agency. Region IV is located in Atlanta.

From the Atlanta office we control the eight southeastern states for the Environmental Protection Agency. We work in Alabama, Georgia, Mississippi, Florida, Kentucky, Tennessee, North Carolina and South Carolina.

We are here tonight to talk about the Carrier National Priorities List Site. The way the meeting is going to be held tonight is -- we have an agenda. I hope everyone has gotten copies of the handouts up front. If you do, there is one

of them that has got the agenda right up front. This will have the handouts that will be used later on to talk about the Remedial Investigation and the Feasibility Study that has been done on the Carrier Site.

There is also a whole slew of additional handouts that tells you about the Superfund process, and a little bit about the contaminants at the Site and the proposed plan that we are here to discuss tonight, et cetera. So, please, if you have not, make yourself available to all of the copies that are up front.

We have a court reporter here tonight, Darlene, and she is going to be taking down everything that we say so that we have a record of the meeting tonight. Like I said, we are going to run about an hour presentation, or hopefully less, if we can do it. Then we are going to turn the meeting over to questions and answers. I will moderate that.

In order to get through in an hour, what I would ask everyone to do is to hold your questions until the end of the presentation and then we will stay here as long as is needed to answer your questions. With me here tonight, we

have a number of people. I would just like to introduce a few of them.

With the City, Steve Schertel, the City Administrator. Steve, I appreciate you coming. We met with the mayor earlier today, and Steve, to kind of go over what we are going to present tonight.

James Mathis, the City Director of the Public Works Department.

Beth Brown. Beth is the Remedial Project Manager at the Environmental Protection Agency. She is the one that is responsible for the day-to-day activities of the Carrier Site for the Environmental Protection Agency.

Suzanne Durham. Suzanne Durham is the Community Relations Coordinator. She works at the EPA, Region IV, with Beth and I. She is responsible for the community relations at this Site and other National Priorities List sites.

Lee Thomas. Raise your hand. Lee is a hydrologist in the EPA's Water Division. He is here tonight to hopefully answer any of your questions about ground water.

Glenn Adams. Glenn is a toxicologist, and he is also in the Water Division. He is here

to answer any questions about the public water and health affects and those kinds of things.

Pete Raack. Pete is an attorney. He is with our Office of Regional Counsel at the Environmental Protection Agency, Region IV. He is here if you have any questions regarding the law or the statute or matters of those sorts.

Jordan English. There we are. Jordan is with the State of Tennessee. He is with the Division of Superfund. Hopefully, if you have any questions about the State's activities, Jordan can answer them.

Ed O'Neal. Ed is with the State of Tennessee with the Drinking Water Division, so he is here to answer your questions that you might have about the State program in that regard.

So I think we have got enough people here to answer the majority of your questions. If we can't, we will certainly take them down and get back with you. Again, to go over the agenda, we are just basically going to -- I am going to go over the Superfund process in general with you.

Beth will go over the Site background and the Remedial Investigation that was conducted at the Carrier Site. Beth will also go over the

results of the Feasibility Study and the EPA's recommended alternative. She will tell you a little bit about what we are proposing next for the Site. Then Suzanne Durham will talk about community relations at the Site. Then we will basically open it up for questions and answers.

Let me explain just a little bit about Superfund and how it is funded. Congress, in 1976, passed a law, the Resource Conservation and Recovery Act, to regulate hazardous wastes, as it is generated at plant sites. That, obviously, was only a regulation that covered hazardous waste as it was generated after 1976. Actually, the regulations to regulate hazardous wastes that were promulgated after that statute were only developed in 1980.

But it left sort of a gap. There were no laws to cover dump sites of hazardous substances that were created before that statute was put in place. So in 1980 they passed the Comprehensive Environmental Response, Compensation and Liability Act, or what is commonly known as Superfund, to cover sites that were created before the legislation was put into effect to regulate hazardous wastes.

It provides a broad federal authority to respond to known releases or potential releases of hazardous substances. The funds or the monies that run the program are generated from the chemical and petroleum industries. Again, a lot of the information about Superfund, in general, is in several of the handouts up front, so if you need more information, certainly, refer to them.

The trust fund itself, which was put in effect to run the Superfund Program, in 1980, Congress passed the statute, and they funded it with one point six billion dollars, and that statute ran out actually in 1984. In 1986, they amended the trust fund and added another eight point six billion dollars. In 1990 they amended the fund yet again and added five point one billion dollars. That current funding lasts until 1994.

Now, in addition, when this funding is -- let me explain a little bit. This fund was really meant to be a sort of self-perpetuating fund. The EPA or Congress recognized that there would be certain abandoned sites where there were no known potential responsible parties, where the government would have to go out and actually spend

federal dollars.

They also realized there would be a lot of sites where there were potential responsible parties, where we could recoup monies that were spent and actually go back into the fund. So every year we actually spend money, but we recoup a lot.

Right now, we are running about seventy percent of our sites nationwide are going what we call potential responsible party lead, where the potential responsible parties; the generators, the transporters, the owners, the operators of the site, are actually paying for the cleanup, and not the federal government.

The Superfund strategy is, basically, control of immediate threats first to clean up the worst long-term contamination problems first, to emphasize enforcement, to seek new technologies, and to improve the efficiency of program operations, and to welcome the community's input all through the process.

As I started this speech out with, in 1976 hazardous substances or hazardous wastes were not regulated at all in this country, by any specific statute. So here we are in 1992, the

technologies that we have are developing along with the regulations. In fact, they are developing a little bit behind. So it is basically a new technology.

Again, to respond to all of those releases, there are basically two main authorities in the Superfund Program. The first is the removal authority. That gives the EPA the authority to respond to immediate health threats; drums that are out leaking in a field that kids can be exposed to.

The other authority is what we are here to talk about tonight. That is our remedial authority, which gives us the authority to respond to long-term, potential threats or the threats that don't cause any immediate human health problems or environmental problems, but if left unattended would in the future.

Again, removal actions may include building fences, removing drums, providing alternate water supplies, and relocating residents that are affected by a site. Nationwide, the Agency has conducted over two thousand removals to date, and over four hundred in Region IV.

The Remedial Action that we are here to

talk about tonight has two main phases. One is the Remedial Investigation and Feasibility Study, which we are here to present tonight, essentially, where we go out and find an extent of a problem site and then a Feasibility Study is to basically determine what technologies are appropriate for that type release.

The Remedial Design or Remedial Action is the second major phase of the Superfund Program. That's where we will be a little bit later in the program, at the Carrier Site. That is where you basically go out and design the remedy for the site, and then Remedial Action is where you actually implement that remedy.

The EPA learns about hazardous waste sites from a number of avenues. Obviously, through reports of generators, haulers, transporters, citizens' complaints, routine inspections that the Agency goes out on, et cetera. Occasionally, the mayors of towns tell us about releases of hazardous substances. I notice that the Mayor snuck in there in the back. They occasionally let us know about sites.

Preliminary assessment is basically the first phase of site identification. Jordan

English, for example, gets involved in a lot of these where someone will call in and complain about a site and give the EPA information about a site, and we will go out and basically do a kind of a windshield, walkover inspection to see if there is a problem or there is not a problem.

Nationwide, we have done over thirty thousand preliminary assessments of uncontrolled hazardous waste sites. Of those, about nineteen thousand required no further action, and in the remaining eleven thousand it required site inspections.

Site inspection is basically the second phase of a site identification, where you go out and actually collect samples, evaluate environmental data; soil, air, water, whatever the particular media is, to see if further action is warranted. After the site investigation, the site will be considered for the National Priorities List.

To go on the National Priorities List, every site is ranked using a hazardous ranking system, which is a little hard to explain, but it is basically a system where you give points to a site based upon the hazards that are posed to the

health, the public health and environment. It is a numerical system where it allows the EPA to rank sites and hopefully work on the worse sites first.

Every site that goes on the National Priorities List has to exceed a score of twenty-eight point five to go on the National Priorities List. Again, this is the slide that more or less explains what the hazardous ranking system is. Again, it is a numerical system where sites are ranked on releases to groundwater, surface water, and air. Those scores are put together. A lot of what impacts is the number of people that are living around the site, the number of residents that may be exposed to that particular release, and any sensitive environmental habitats.

Again, the National Priorities List is a list of the nation's highest priority list sites. We update it on an annual basis. Currently, there are a little over twelve hundred sites on the National Priorities List. We are adding, nationwide, about one hundred sites a year.

In Region IV, the eight southeastern states currently have one hundred and sixty-three

National Priorities List sites. One of the things that is important about the National Priorities List is only the sites that are final on the National Priorities List are eligible for funding out of the federal program.

This is just a little rundown to tell you what we are doing nationwide. There is approximately twelve hundred sites. Sixty-three have all the cleanup actions completed. Two hundred and seventy-two have the cleanup work underway. One hundred and fifty are currently in Remedial Design. One hundred and fourteen have the remedies selected.

Five hundred and four have the investigations underway, and one hundred and thirty-three have been evaluated for immediate threats, and removal actions, if appropriate, have been taken. Just for reference, on the Carrier Site, we are about here in the middle. We are at the remedy selection stage.

Another question that frequently comes up is how long does it take to run a site through the National Priorities List, and the system, how much does it typically cost to remediate the site. From the time the site is discovered to the time

it takes to get on the National Priorities List and actually begin the cleanup is running around seven to ten years.

The average cost of the National Priorities List sites nationwide is around twenty-six million. The investigations are taking approximately two years to complete. Those investigations are costing approximately one million dollars to complete. The Remedial Designs are taking a year to a year-and-a-half, and they are running about one million dollars to complete.

I just want to sort of show everybody where the National Priorities List sites are in Tennessee. These dots are where we have sites. You can see we have four or five right in this corner of the State. I will run down what those sites are. Naturally, we have the Carrier Site, here in Collierville.

We have the Gallaway Pit Site, which is in Gallaway. We have the Arlington Blending Site, which is in Arlington, also in Shelby County. We have the Velsicol Hardeman Site, which is in Hardeman County, but the waste was generated here in Memphis. Over in Jackson there is the American

Creosote Site. So there are several sites in this vicinity.

After you get out of this area, they sort of scatter across the State. There are actually fourteen sites in Tennessee. Twelve are private, and two are federal sites.

All right. Now I will turn it over to Ms. Brown.

MS. BROWN: As Harold said, my name is Beth Brown. I have been the Remedial Project Manager for the Carrier Air Conditioning Site for the past three years, during the time we have been conducting the Remedial Investigation and Feasibility Study.

The information that I am about to provide is only a summary of the past two years that we have been conducting the RI phase, or the Remedial Investigation and Feasibility Study. If you want more information, more details, you can find that information in the Administrative Record that is located right here in the library.

As most of you are aware, the Carrier Site is located at the intersection of Byhalia Road and Poplar Avenue. To give you some background on the Carrier Site, Carrier has been

manufacturing air conditioning since about 1971. Trichloroethylene, commonly referred to as TCE, was used, until recently, primarily as a solvent to clean and degrease the manufacturing parts necessary to manufacture the air conditioners.

Two releases of TCE have occurred near the manufacturing plant building in 1979 and 1985. In addition, a waste water lagoon, operated from about 1972 to 1979, apparently accepted waste that was inadvertently contaminated with TCE and zinc.

Removal actions were conducted at both the former lagoon and also at both the near-plant spills. Since 1985, groundwater monitoring wells were installed under the oversight of the Tennessee Department of Environment and Conservation.

In 1986, as part of the routine monitoring, one of the extraction wells, located at the Town of Collierville's Water Plant 2, which is located on the northwest corner of Carrier's property, was found to be contaminated with low levels of TCE. Operation of that plant has continued under frequent monitoring and still, to this day, does.

In 1987 and 1988, Carrier conducted a site investigation under an agreement with TDEC, and found that the Site's soils and groundwater were contaminated. The Carrier Site was proposed on EPA's NPL in 1988 and became final in 1990. In 1990, due to the routine monitoring, it was noticed that TCE was continuing to increase, but still below the maximum contaminate levels. As precautionary measures, air strippers were installed to assure that removal of TCE would occur.

The EPA conducted an RI at the Site from 1990 to 1992, primarily to determine the nature and extent of contamination, and also to assess the risk to human health and the environment.

To give you an idea of the work that was performed under the Remedial Investigation, as you can see, we have done quite a bit of work; thirty-seven groundwater monitoring wells, eighty-seven surface, and eighty-seven subsurface soil samples, five surface water samples, and five sediment samples. As part of our routine operations during the RI, air monitoring was conducted at all times.

Well, that is a little hard to see on the

overhead, but if you look at your handout, I believe the first one is soil borings. This is just to give you an idea of where the soil boring samples were taken. The next one, that is just as hard to read, is the monitoring well location map per monitoring wells that were installed on the property.

The next figure is for off-site property wells, which you can probably read a little better. In addition to the off-site property wells that were installed, En Safe, under Carrier's supervision, also monitored Water Plant Number 1, and also monitored two or three other background wells. In addition to that, fifteen samples were taken from private wells.

What our investigation revealed was that the contamination was primarily TCE, and was found in both the shallow and deep aquifers at levels above the MCLs. Soil contamination was found in the 1979 and 1985 spill areas and the lagoon area.

At this time, Harold, if you could put up the map of the Memphis Sands, if you can find it. It is in your handout, as well.

What we found was contamination migrates

from soils. This is the lagoon area, and this being the plant area, and migrates from the soils to the shallow aquifer, and primarily flows in this direction to the area, and this is the clay formation, and migrates along the top of the clay to the area where the clay is absent, and then flows to the Memphis Sands in this direction.

We also took surface water and sediment samples, and we found no TCE contamination or any other site-related contamination. During the RI, no air releases of TCE occurred except when we were using evasive activities; putting in monitoring wells, or soil borings.

The contaminates of concern in the Site soils and the groundwater, as you can see, we have seven; TCE, DCA, DCE, PCE, vinyl chloride, lead and zinc. Of those contaminates, the ones that we are primarily concerned with, and that are driving us to take action at the Site, are lead and zinc.

Also, it is -- I am sorry. It is TCE and lead. As part of the RI, we conducted a Treatability Study at the former lagoon, which was soil vapor extraction, and it has been effective in removing TCE and its natural degradation products, being DCE.

As you can see, this is the map showing the primary soil contaminated areas at the lagoon area and the 1979 and 1985 spill area.

What we concluded from the RI was, one, that we needed to prevent ingestion of the groundwater that was contaminated at or above the MCLs. We also wanted to prevent further contamination of the Memphis Sands, being the soils migrating, or the shallow groundwater that is migrating to the Memphis Sands.

We also want to restore the Memphis Sands aquifer to drinking water conditions, and also prevent migration of contaminated soils that would cause the Memphis Sands to exceed MCLs.

The next step in the process was to conduct a Feasibility Study. That was conducted in the Spring of 1992 to develop and evaluate cleanup alternatives for the Site. We identified six possible alternatives, and evaluated using eight of the nine evaluation criteria. The ninth criterion, community acceptance, will be evaluated during the public comment period.

Technologies we considered for groundwater treatment were ultraviolet light-enhanced oxidation. This technology

converts contaminants using a chemical reaction with ultraviolet light to convert contaminants to a less toxic form.

Also considered for groundwater treatment is air stripping. This is a technology that involves contaminated water entering a packed tower, flowing downward, and the air flow is upward, volatilizing contaminants from the air. The treated water then exits the tower and is either discharged to streams, municipal water supplies, or publicly owned treatment works. The air either exits the tower and is treated further, or it is released to the air with no treatment.

For soil treatment we considered soil vapor extraction. This technology applies a vacuum stress to soils. The contaminated air exits the surface or is treated further.

LTTD was also considered. This uses a low temperature to volatilize contaminants from the soils, and the volatilized contaminants are treated by an off-gas system, and the solids are then destroyed in an afterburner or collected by a physical treatment process.

For air treatment, we considered carbon adsorption, thermal treatment, and ultraviolet

photolysis. Carbon adsorption, in this system, vapors are passed through a chamber that contains carbon. Organic contaminants attach themselves to the carbon.

In thermal treatment, the contaminants are heated to such a state that there is complete destruction. In ultraviolet photolysis, it is the same as in ultraviolet light-enhanced oxidation. It uses a different chemical reaction, and can be used for air treatment.

The disposal actions that we considered are groundwater discharge and hazardous waste disposal. Groundwater can be discharged after treatment to the public water supply, to surface water, the POTW, which is a publicly owned treatment works, or reinjected into the Memphis Sands.

Hazardous waste disposal, from the contaminated groundwater that is treated, when you use carbon, your carbon becomes contaminated, and you can either regenerate it or send it off-site for regeneration or possibly landfill. The soils that were being treated in the LTTD will not be remediated in place but removed and either after treatment placed back on site or shipped off-site

for disposal.

Using these technologies, we put together six possible alternatives. The first alternative that we are required by CERCLA to evaluate is if no action is taken. In this case no action also considered routine monitoring. The cost for this alternative was approximately one point four to two point two million.

In Alternative 2, the North Remediation System is a Treatability Study that I referred to earlier that uses soil vapor extraction at the area of the former lagoon. Also considered for groundwater containment and treatment at Water Plant 2 is the continued operation of the City's well filled with air stripping.

Alternative 3 is the same as Alternative 2, but also contains soil vapor extraction in the main plant area. The cost for Alternative 2 is about three to four million. The cost for Alternative 3 is approximately five point seven to seven point five million.

Alternative 4 includes everything that was included in Alternative 3, but also includes supplemental wells for additional groundwater containment and also to try and capture

contamination from the shallow aquifer as it enters the Memphis Sands. We considered for treatment of groundwater at the supplemental wells air stripping or ultraviolet oxidation.

Alternative 5 is the same as Alternative 3, except that in the area of the plant area, where it is contaminated, we will apply excavation to approximately fifteen feet, and at depths below fifteen feet use soil vapor extraction.

Alternative 6 is the same as Alternative 4, in that it provides for additional groundwater containment, and it also applies plant area soil excavation and LTTD. I am sorry. The cost for -- I don't believe I gave them for 5, either. The cost for 5 is approximately six point one to eight point four million, and for Alternative 6A, nine point eight to fourteen point five. For 6B, which is ultraviolet oxidation, ten to fourteen point nine million.

The EPA is recommending Alternative 4A, the North Remediation System, SVE at the main plant area, groundwater containment and treatment at Water Plant 2, and with supplemental wells, utilizing air stripping. This alternative will also include the placement of institutional

controls on land and water use on the Site, and on the water use in the general area.

At this time I would like to explain the institutional controls that we are considering, and that would be for the shallow aquifer. The shallow aquifer was not considered a primary pathway of concern. The reason we are concerned with the pathway is that it does provide a conduit for contamination in the Memphis Sands.

This is primarily an on-site problem. The shallow aquifer does have contamination just off-site. This county has a Water Quality Control Board that basically reviews any applications for the installation of monitoring wells.

At this point we feel that that may be adequate and no deed restrictions will be necessary. Also included in this alternative is periodic monitoring to assess the effectiveness of the remedy for at least the next thirty years.

The treated water from the extraction wells will either be; utilized in the municipal water supply, which at this time we feel is the best alternative; or discharged to a local water supply; discharged to surface water; or reinjected into the Memphis Sands.

Due to the technologies that we have considered; air stripping, and soil vapor extraction, it will be necessary to meet any air quality standards using off-gas systems, such as carbon adsorption, a fume incinerator, or ultraviolet photolysis.

Again, we will meet any administrative requirements for the air emission limitations, the water quality discharge, any reinjection requirements and/or approval for the off-site disposal of hazardous waste, those of which will be determined during the Remedial Design.

This is an example of soil vapor extraction that is considered for Alternative 4A. Basically, you can see that the extraction wells are located in the soils and vacuum out or volatilize contaminants from the soils and are forced into the vapor-liquid separator and vacuum pump, and is either treated further or is released to the air.

An example of air stripping is water is forced down through the column. Air blows the water and volatilizes the contaminants. The water is released at the bottom of the tower, and the air is released through the top of the tower,

either for further treatment or is just released.

The EPA prefers this alternative for the following reasons: It is protective of human health and the environment. It does provide reliable protection over time, with minimal risk. It ensures contamination does not migrate off-site, and will minimize further contamination of the Memphis Sands.

It does utilize a permanent solution. Its uses are proven and widely available technologies. It does reduce toxicity, mobility, and volume of the contaminated soil and groundwater, and it is cost effective. Lastly, it satisfies the EPA's preference for treatment as a principal element.

Where do we go from here. The next step. The public comment period began on April 21st, and will end on May 21st, unless an extension is requested for another thirty days. During the next few months the EPA will respond to the comments received and the responses will be summarized in a document called the Responsiveness Summary.

The EPA's final choice will be documented in the Record of Decision, and is anticipated to

be issued in August of 1992. The ROD, which includes the Responsiveness Summary, will become part of the Administrative Record, which is located here in the library.

After the Record of Decision is signed, and the Remedial Design and the Remedial Action, we will begin negotiating with Carrier Air Conditioning, and those should be completed by November of 1993. We anticipate to begin the Remedial Action in November of 1993. We estimate the time to remediate the soils will be three to five years, and the time required to remediate the ground water will be less than thirty years.

Also, in your handout we have also put my name, Suzanne's, and Jordan English, if you have any questions. At this time I will turn it over to Suzanne.

MS. DURHAM: Good evening. My name is Suzanne Durham. I am just going to reiterate some of the things that Beth and Harold have already told you. We are here tonight to explain our long-term Remedial Investigation, and to offer a proposal for cleanup of the Carrier Air Conditioning Site.

Choosing the final response action is

probably the most important decision ever made in the Superfund Site, and when we get to this point in the process, we strongly encourage the citizens who are most effected by the Site to be a part of that decision-making process.

We have recently issued the Proposed Plan Fact Sheet, which summarizes the findings of our Remedial Investigation and Feasibility Study. We also sent the Administrative Record to the library, to the information repository here in this library. I hope that you have all had a chance to study that Proposed Plan Fact Sheet and to look at the Administrative Record. If you have not had an opportunity yet, please do so. Ask us questions tonight about our presentation, and then submit your written comments to the Agency.

The comment period began April 21, and extends through May 21, 1992. We can grant an extension if you need additional time to prepare your comments. After the comment period ends, the EPA will prepare a document called the Responsiveness Summary, which will summarize your comments and our responses to your comments.

After that document has been prepared, our regional administrator will sign the Record of

Decision, and both of those documents will be available to the public in the Administrative Record here in the library. We will issue a notice in your local newspaper letting you know what our final decision is.

An excellent opportunity for community involvement is through our Technical Assistance Grant, or the TAG Program. Congress recognized that our documents are quite lengthy and highly technical in nature. We can now offer a grant in the amount of fifty thousand dollars to a community group who is interested in hiring your own technical advisor to interpret the data that we generate. There is a fact sheet on the registration table if anybody is interested in that.

In summary, the goal of the Community Relations Program is to keep you informed and involved about complex decisions which will affect you here in the community. Beth and I are your two main contacts at the EPA. You have our names, addresses, and phone numbers in your fact sheets. Don't hesitate to call either one of us at any time.

Now I think we are going to go right on

into the question and answer period.

MR. TAYLOR: All right. Again, I will leave this on, because we might need it. We are going to be here until hopefully we answer your questions or at least know what they are so that we can get back with you.

Since we do have a court reporter here tonight, and we are trying to get a record of the meeting, what I am going to do is ask you to stand, or at least project your question enough so everyone can hear and so she can get a good record of it.

Also, I would ask you to state your name, and if you have a name that is difficult to spell, I would ask you to spell your last name the first time you ask a question, so we know who asked the question.

If you direct your question to me, then I will try to address it, and if I can't, I will get some of my cohorts here to pipe in and finish it up. So do we have any questions?

Yes, ma'am, in the back. Your name, please.

MS. JOHNSTON: Melanie Johnston.

MR. TAYLOR: Go ahead.

MS. JOHNSTON: I would just like to know if trichloroethylene is still being used at the Site.

MR. TAYLOR: No, ma'am. It has been discontinued in the manufacturing process.

MS. JOHNSTON: Oh, it has. Great.

MR. TAYLOR: Yes, ma'am?

MS. FONTAINE: Daisy Fontaine, from the Collierville Herald. My question addresses the toxicity of any remaining substances in the Collierville system.

MR. TAYLOR: Okay. I will probably let Glenn Adams handle that a little bit. Right now, you know, it -- let me see if I can explain it. Let me just get the slide right here.

MR. JORDAN: Could you repeat the question?

MR. TAYLOR: Okay. Yes. Go ahead.

MS. FONTAINE: I just asked a general question on the toxicity remaining in the aquifers, for both the shallow and the Memphis Sands, and if anything is continuing to go in the Memphis Sands. That would have been a better question.

MR. TAYLOR: If you can see, we

have -- this is the manufacturing plant. This, which is, again, hard to see. This is the City of Collierville well. These are the two main areas that releases have occurred. Those releases have occurred, you know, back years ago, in 1979 and 1985, I believe.

Our sampling, on the surface of the Site, we really didn't find any surface soils of any concern. On the sampling in the creek, we didn't find any surface water or sediment of concern. The concern really is as the contaminants flow along this shallow aquifer and then are released to the Memphis Sands and then flow back towards this withdraw well. As they do, of course, the contaminants that are fairly high in concentration here get diluted, and as they move here they become lesser and lesser concentrations.

Then when they are pumped to this well, those contaminants are stripped off using the air stripping, and the public water supply itself is currently okay, safe, not contaminated with TCE. So the real threat that we are addressing with the Remedial Action would be if this well would no longer have the air stripper or if someone were to stick a well in here and start using this water.

So we are really addressing not really a current threat so much as we are a potential future threat.

Glenn, do you have anything to add to that?

MR. ADAMS: I think Harold has probably answered your question, but what we did -- you will have to excuse my voice. I am trying to get over some sinus problems.

As we looked at, as Harold said, the shallow soils, where most of these chemicals are very mobile in the soils, so they don't stay around the top very long. They leach with the rainwater down into the groundwater. We looked at the soils.

We looked at the current exposures to the workers on the Site, and future exposures, of course, to workers, and if some day these buildings were to be gone, if someone would build a residence on that. The soils came out to be negligible and in the risk area. The groundwater is the significant problem here.

The reason why we want to do something with the soils is because of the contaminating groundwater. Not from the risk of humans being

exposed to the soils. The groundwater does present an unacceptable risk for future use.

Right now there is no current risk to the groundwater on that side of the Site. The only current risk is with this municipal well, which with the air stripper, everything is below the detection limit. In other words, we cannot detect any chemicals in the water that is going into the system.

MR. TAYLOR: Yes, sir? Did you have a question?

MR. LACHAPELLE: My name is Norman Lachapelle, L-A-C-H-A-P-E-L-L-E. I just want a further clarification on your clay bearing formation, your Jackson Clay. Is that a pretty good, prominent layer of clay for the Site?

MR. TAYLOR: I may ask Lee Thomas, our hydrologist, to sort of describe the clay. I think this is a pretty good depiction of the clay underneath the Site.

MR. LACHAPELLE: Okay. I am hearing that you have not found any TCE contamination in the groundwater as of now.

MR. TAYLOR: No, sir. There is TCE in the groundwater right now.

MR. LACHAPELLE: How far down?

MR. TAYLOR: What is this depth? I may get Lee to sort of help me here.

MS. BROWN: I think it is about sixty or seventy feet.

MR. TAYLOR: Sixty or seventy feet.

MR. THOMAS: Sixty or seventy feet, yes. Do you want me to take over?

MR. TAYLOR: Yes. Go ahead.

MR. THOMAS: Basically, what has happened, as Harold has pointed out, the contamination from the soils has moved down. It has hit the top of the clay, and then it moves along the top of the clay to the place where the clay pinches out, and at that point then it enters the drinking water aquifer, which is the Memphis Sands.

MR. LACHAPELLE: It has not done this yet?

MR. THOMAS: There is some contamination.

MR. LACHAPELLE: I hear yes, and I hear no.

MR. THOMAS: There is some contamination right at the very top portion of the

Memphis Sands. That is correct. We do have one deep well that goes down in the Memphis Sands where we do have some contamination that has moved off the top of the clay. So the clay is not a confining zone. It is continuous across the Site. It does pinch out.

That is one of the things that we are concerned about, and the reason why we are going to have additional extraction wells to prevent additional contamination from moving off the clay and endangering the Memphis Sands. Also, to clean up the contamination that is already in the Memphis Sands.

So that the issue about the contamination of the drinking water aquifer, the future contamination, as well as the existing contamination, will be addressed with a selected alternative.

MR. LACHAPELLE: So the Memphis Sands are about three hundred feet?

MR. THOMAS: Right, but the contaminations in the Memphis Sands is just where it has flowed off the edge of the clay layer and into the upper portions of the Memphis Sands.

MR. LACHAPELLE: Okay. Thank you.

MR. TAYLOR: I think perhaps the confusion was we are saying that once this water is pumped up and treated and distributed to the public water supply, there is no TCE in the water at that point.

MR. LACHAPELLE: My major concern is the TCE getting in contact with our Memphis aquifer. That is the major concern.

MR. TAYLOR: That is what this remedy is going to address, yes, sir.

MR. LACHAPELLE: Thank you.

MR. TAYLOR: We traveled all the way from Atlanta to come here, so surely there is more than just a couple of questions. Yes, sir?

MR. YEGANEH: My name is John Yeganeh. That is, Y-E-G-A-N-E-H. I would like to know the difference between Option 4A and Option 4B, and why do you then choose 4B, or why do you choose 4A against 4B.

I also have a second question. You are mentioning here that you will adopt some air pollution control, like an incinerator or carbon adsorption. If your monitoring shows that you are over the standards, the Air Quality Standards, are you meaning the National Ambient Air Quality

Standards, or what do you mean by Air Quality Standards here?

MR. TAYLOR: Well, we will have to meet -- to answer your last question, we will have to meet whatever standards apply to the Site. Under Superfund, we won't necessarily have to get a permit, but we will have to meet the administrative --

MR. YEGANEH: What is the standard, is what I am asking here. What is the standard you are mentioning here?

MR. TAYLOR: Well, are you in the Air Program?

MR. YEGANEH: I am in the Air Program, yes, sir.

MR. TAYLOR: What standards would apply to the plant or to any site, any rules of --

MR. YEGANEH: There is some National Ambient Air Quality Standards for the ozone, which TCE can affect the ozone. Are you talking about the ozone National Ambient Air Quality Standard here? That is what I would like to know.

MS. BROWN: This is a non attainment area for ozone.

MR. YEGANEH: That's true.

MS. BROWN: We will meet those requirements.

MR. YEGANEH: So you are not saying that you are going to have a carbon adsorption or or fume incineration right now. You are waiting to see if you exceed the standards?

MS. BROWN: We don't know right now. At this point in time, with the current systems in place, the soil vapor extraction at the lagoon area, and the air stripper, right now the monitoring indicates we have no emissions over those standards.

Now, when we put in the rest of our systems, we have not done the designs yet. The designs will give us the information we need to know about what type of system we need on there. We will design to meet those standards.

MR. YEGANEH: Okay.

MR. TAYLOR: Those questions will be answered in the Remedial Design.

MR. YEGANEH: Could you answer my first question, which was the difference between Option 4A and 4B, and why did you choose 4A.

MS. BROWN: I would be glad to. Basically, we chose 4A over 4B because air

stripping is a more proven technology. There are associated problems with UV oxidation in that you have bulb burnout, bulb replacement. The monitoring is much -- you have to maintain monitoring much more stringently than you do with the air stripping.

MR. TAYLOR: Plus, you know, because this is going to be a pump and treat system, we may be false pumping. We may be doing a lot of things to refine the system. With the UV lights, it is more adaptable, in my opinion, anyway, to a constant flow type process where you know day-to-day what your flow in and flow out is going to be.

In my experience, the air stripping is just a lot simpler and easier and it meets the same goals. The price is not that much different. It is just the implementability of the system, I guess.

MR. YEGANEH: What were the prices for 4A and 4B, would you, please?

MS. BROWN: Sure. 4A was five point seven to seven point nine million, and 4B is six point one to eight point four.

MR. YEGANEH: Six point one?

MS. BROWN: Yes. In the proposed plan, I believe, if you look, there is an evaluation table that basically explains the differences between the two. Also, a pilot study would have to be done for UV oxidation.

MR. YEGANEH: Thank you.

MR. TAYLOR: Are there any other questions?

MR. LACHAPELLE: Yes, I have one more.

MR. TAYLOR: Yes, sir.

MR. LACHAPELLE: Norman Lachapelle again. The well on the screen, has that been secured? Is that a City groundwater well?

MS. BROWN: I am sorry? Has it been --

MR. LACHAPELLE: Has the well been secured? I mean, is it in operation?

MS. BROWN: Yes.

MR. LACHAPELLE: Does it have any trace of TCE?

MS. BROWN: After treatment, no.

MR. LACHAPELLE: After treatment, but it has before treatment?

MS. BROWN: That is correct.

MR. LACHAPELLE: Who is checking -- who is doing the testing? The City?

MS. BROWN: Both the City and Carrier's contractor, En Safe, with the EPA's oversight.

MR. LACHAPELLE: Thank you.

MR. TAYLOR: So what we will do in the future, as far as with the Remedial Design or Remedial Action, we will continue that, formalize all those requirements in a consent decree, which will be lodged in a Federal District Court just to make sure everything is being done properly and there will be -- if things are not done properly, there will be stipulated penalties and et cetera, et cetera.

It sort of is -- the way I see it, a lot of this is being done right now, but we are going to sort of codify that to make sure it continues in the future and that we have a mechanism to control it.

MR. LACHAPELLE: Is that the only City well contaminated?

MR. TAYLOR: There are actually two wells.

MS. BROWN: At this plant, this is

the only plant that has shown contamination. The other two plants have not.

MR. LACHAPELLE: Good.

MR. TAYLOR: If there aren't any other questions, we will be around if you want to come up and talk to us individually. Again, we appreciate everyone coming out tonight. We do have the Administrative Record just next door in the library. We will welcome everyone to come look at it. We welcome everybody to look at the proposed plan and send any written comments that you may have, and to give to Suzanne or Beth or I a call at work.

Again, we will be around for a few minutes. If you want to come up and talk to us, we will be glad to talk to you then. Again, we appreciate you coming out tonight. Thank you.

(Whereupon, said proceedings concluded at approximately 8:00 p.m.)

AMENDMENT SHEET

I, the undersigned, BETH BROWN, do hereby certify that I have read the foregoing proceedings and that, to the best of my knowledge, said proceedings are true and accurate with the exception of the following corrections listed below:

PAGE / LINE /

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ _____

Date Signature of Witness

Sworn to and Subscribed before me,
this ____ day of _____, 1992.

_____ _____

Notary Public My commission expires

COURT REPORTER'S CERTIFICATE

STATE OF TENNESSEE:

COUNTY OF SHELBY:

I, DARLENE M. SULLIVAN, Court Reporter and Notary Public, Shelby County, Tennessee, CERTIFY:

1. The foregoing proceedings were taken before me at the time and place stated in the foregoing styled cause with the appearances as noted;

2. Being a Court Reporter, I then reported the proceedings in Shorthand to the best of my skill and ability, and the foregoing pages contain a full, true and correct transcript of my said Shorthand notes then and there taken;

3. I am not in the employ of and am not related to any of the parties or their counsel, and I have no interest in the matter involved.

WITNESS MY SIGNATURE, this, the 22nd day of May, 1992.

Darlene M. Sullivan

DARLENE M. SULLIVAN
Court Reporter
Notary Public
for Shelby County, Tennessee

My commission expires: February 8, 1994